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by LT COL E. E. Poor, USMC

Inflight

Inflight troubleshooting, as such, encompasses an extremely large field in aviation. It means locating, isolating and where possible correcting airborne malfunctions of equipment/human actions that can create emergencies and lead to aircraft accidents. This term then could apply to the situation where a crewmember in a P-2 is dispatched to the radar well in flight, to locate and correct a discrepancy that is prohibiting normal radar operation. On the other hand, it could apply to the radioman in a C-54 who in flight changes a tube in his VHF receiver, and makes available to the pilot the otherwise useless radio.

For the purpose of this article, however, we will consider only the pilot of a high performance jet fighter aircraft. This seems to be the area where greater demands are imposed on the pilot, concerning decisions, troubleshooting and actions which require immediate correct response.

With the advent of high performance type aircraft, and the increased complexity of modern machines and equipment, the importance of coping with airborne emergencies and conducting sometimes rapid troubleshooting, has increased many fold. Despite the best

The EGT started to rise and EPR to drop—all other instruments normal...

ttroubleshooting

conscientious efforts of designers and maintenance personnel, every once in a while, an aircraft will wind up with bent feathers or something coming unglued. When airborne, this condition almost automatically gives the pilot a case of some magnitude of what is commonly called "compound concern"—at least until he finds out what gives or has gone. This reaction is considered normal in most aviation circles, since any emergency between takeoff roll and the chocks is at least a cause for some alarm.

Fortunately, most types of emergencies were foreseen by some of the chalk experts who play with funny looking tools like $KE = \frac{1}{2} MV^2$ and $D = C_D q S$. So, gadgets and procedures have been designed to get us back on the ground in one piece. Unfortunately, however, too many airborne emergencies end in a pilot-caused accident. Sometimes this accident is a direct result of improper troubleshooting—when the before-the-fact easter egg was in plain sight, if only the driver had looked in the right place. However, by taking a quick glance at the psychological stresses affecting our decision-making processes when it comes troubleshooting time, we will see that complete familiarity with the machine is a must.

This applies in every case, and is of paramount importance in those types of difficulties where the driver could have made a somewhat normal landing without further incident—but didn't.

Airborne emergencies can be divided into two general groups, as far as their urgency is concerned.

These are:

Get out now!

and,

Let's see what we got here!

The first type does not merit much comment here since only two things are necessary—

(1) the ability to recognize that it is actually that type of emergency (this is one form of troubleshooting), and

(2) working knowledge of ejection procedures. The rest generally follows in rapid succession.

The second type differs primarily in that the time element is not critical. Usually the driver has some time at least to observe symptoms and exercise his troubleshooting abilities—arrive at a conclusion and act.

This may seem to take an eternity. But actually,

it occupies comparatively few seconds of time, if the pilot has control of the machine. If he doesn't—then it undoubtedly falls in the first category of emergencies, and means he will probably be making a nylon letdown provided he has arrived at the correct answer in his analysis.

Now that we have time to troubleshoot—why do so many airborne emergencies create pilot-caused accidents?

The answer to this one seems to lie somewhere around the word "judgment."

"Judgment" by definition, is the capacity for logical thought—an aspect of intelligence. Most pilots possess at least an average share of this capacity.

Why the failures? Psychologists tell us that failures in judgment are due almost solely to lack of time, lack of knowledge and lack of motivation.

If we have a reasonable amount of time, then many of the failures in judgment are due to lack of knowledge—not knowing the correct thing to do—improper troubleshooting and solution.

This can be corrected, it would seem, by some handbook study, discussion and practice. If you know your machine and have to troubleshoot and determine corrective action, then you have only to guard against complacency.

Decisions as we know are based on fact or what we believe to be the facts as interpreted by our senses and transmitted to the brain. Failures of the decision-making process of trained aviators therefore result from the lack of knowledge of what the airplane and its gadgets are trying to tell or indicate.

Many pilot-caused accidents have been the result of a strong desire of the pilot to get on the ground even though the emergency encountered may have been corrected.

On the other hand, numerous accidents have been the direct result of poor troubleshooting. "Has a circuit-breaker popped?" "Is the gage out or really telling you the whole story?"

If you wrongly interpret the symptoms, all the good judgment in the world may not help since it is logical to assume that the answer you derive will be wrong anyway.

It is generally accepted that a pilot of a high-performance jet fighter has little chance for troubleshooting anything he cannot see or feel from his own cramped space in the cockpit. However, a thorough knowledge of what each instrument and gadget is designed to do or tell you and knowledge of the probable consequences of failure of the system it is indicating have to be weighed by the pilot and a decision reached as to what course of action to follow—or, "What now?"

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This, in effect, is what we mean by "inflight troubleshooting." In certain situations our judgment tells us to save the engine by shutting it down although this may not be the thing to do at the time. Reducing power may be the solution to getting the man and machine on the ground safely.

On the other hand, it may well be that the symptoms encountered may dictate an immediate engine shutdown and even more drastic actions.

The nearest correct answer is usually available to the pilot if he has a good working knowledge of all the systems and indicators thereof and their effect, or lack of same, on the emergency or malfunction in progress.

The pilot who continually strives to increase his knowledge of the aircraft and its systems, and who develops the necessary skill for analyzing and taking proper corrective action when inflight trouble occurs, is generally the pilot who arrives safely back in the chocks.

There is no denying that all pilots experience at least some degree of excitement when red lights, flags and barber poles suddenly appear in the cockpit. But we must remember that these devices are there to tell us something so that we can respond in a certain manner. They are not necessarily automatic "jump" signals. Nor do they mean that we can do a good job of getting home and then forget them once we have the runway in sight.

Our egos being what they are, one of the best ways to combat that panicky feeling is to talk the situation over with ourselves and someone else, if available.

For instance, one organization's SOP for all emergencies in the air—assuming communications are normal—requires the wingman (the man with the emergency always becomes the leader) to call out corrective action from his checklist while the pilot with the emergency executes corrective action.

A double check is always better than one!

When inflight trouble occurs, be prepared to act based on a sound knowledge of the aircraft and its systems. This implies preplanning since the basic trouble encountered during inflight troubleshooting is "ignorance"—or at least uncertainty. The time spent in maintenance shops, readyrooms, bull sessions and reading of other pilots' experiences along these lines will be well worth your while and could very possibly save your life.

For a starter on the subject of malfunction analysis for jet engines please read "A Stitch in Time," by N. E. Norden, P&W's Operating Instructions Engineer, beginning on the next page.—Ed

A Stitch In Time

by N. E. Borden

Operating Instructions Engineer
Pratt & Whitney

Early recognition of an engine malfunction followed by prompt and proper pilot action may be all that is needed to avert an accident.

As almost every pilot knows, literally millions and millions of flying hours have conclusively proved that today's jet engines are the most reliable power plants which have ever been built for aircraft. But the intrinsic dependability of the jets can boomerang and become a hazard if it is allowed to lull flight crews into complacency. The record of the jets is so extraordinary that many pilots take trouble-free engine operation practically for granted. Nevertheless, jet engines are still machines. As such, they are subject to occasional malfunction or, in rare instances, even to complete engine failure. Therefore, the possibility of engine difficulty in flight or on the ground cannot be ignored.

A controllable malfunction could conceivably become a serious emergency because of the attitude "it can't happen to me." This has, in fact, occurred many times as attested by tales of incidents which have been recorded from time to time on these pages. The axiom taught by such incidents is obvious. It behooves the pilot and crew who would meet trouble successfully to know in advance how to handle any situation which might arise in order that they may react almost instinctively when occasion demands.

Fortunately, jet engines actually speak a language. Talking through their instruments to pilots, flight crews and ground maintenance personnel who will listen by frequently checking and correctly interpreting the engine instrument readings, the jets communicate about how they are doing and they usually forecast a major malfunction of axial compressor turbojet and turbofan engines that a change in the operating condition of an engine which causes a vibration in the reading of any one of the four primary engine operating instruments (exhaust gas temperature or EGT, compressor RPM, engine pressure ratio or EPR and fuel flow) will also cause the other three primary instruments to vary. Conversely, when only one of the four primary engine instruments, by itself, indicates an erratic or abnormal reading, the cause is most likely an instrumentation system malfunction.

These four primary instruments (EGT, RPM, EPR and fuel flow) should be monitored simultaneously because the interrelationship of their readings at any given time provides the key for determining engine condition and diagnosing incipient trouble. Fuel pressure, oil pressure and oil temperature are not necessarily interrelated and may be monitored individually. A knowledge of what may be wrong when trouble comes will provide the best possible clue to the right course of action in each instance. Many situations can be quickly analyzed and timely measures taken if an engine's malfunction symptoms are understood. On the other hand, misinterpretation of apparent abnormal engine operation and subsequent improper corrective action may possibly cause a more serious situation than was present in the first place.

The guide to malfunction symptoms which follows represents a few, but far from all, of the circumstances which might occur to the afterburning engine, or engines, with which a fighter model airplane is powered. With the exception of malfunctions relating specially to the afterburner, the same symptoms and their probable cause will normally also apply to non-afterburning engines installed in multi-engine bombers, tankers and transports.

These malfunction guides are not intended to serve as maintenance troubleshooting charts. To the contrary, *the malfunction symptoms mentioned are only those which will be apparent to the crew in the aircraft*. Similarly, the action recommended is only that which the pilot or crew may initiate themselves. Sometimes the only action a pilot can take is to shut the engine down or terminate the flight as soon as possible.

In the event of abnormal engine operation of any kind, the incident should be reported by an intelligent, accurate notation on the Yellow Sheet. Whenever possible, the engine instrument readings before and after the malfunctions should be noted. Properly recorded engine discrepancies make for more positive malfunction analysis on the ground and for faster, better corrective maintenance.

POSSIBLE MALFUNCTIONS OF THE BASIC ENGINE

Condition	Probable Cause	Action
Takeoff Engine Check EPR at full throttle higher than computed. EGT, RPM and fuel flow higher than normally experienced for prevailing conditions.	Possible miscalculation, or use of incorrect temperature when determining takeoff EPR. Engine trimmed too high. Possible, but not probable, fuel control malfunction.	Recheck takeoff EPR for prevailing ambient conditions. Continue with the takeoff at the pilot's discretion, throttling back, if necessary, to avoid exceeding maximum allowable value for EGT, RPM and EPR computed from curves or tables in the aircraft NATOPS Manual at the prevailing ambient conditions.
EPR lower than computed minimum for full throttle operation at prevailing ambient conditions.	Engine thrust deterioration due to deposits of foreign material on the compressor blades.	Abort or continue the takeoff at the pilot's discretion, depending upon the circumstances. Report engine for up-trimming or field-cleaning.
Inflight Drop in EPR, compressor stall (slight, snorting or very pronounced), possible reduction in fuel flow and, lastly, a rise in EGT as the condition continues. RPM may or may not fluctuate, or it may drop if the condition continues.	If condition occurs during suspected inlet icing conditions, possible accumulation of ice on engine air inlet section. Particularly if accompanied by compressor stall, may indicate engine ingestion of ice, with or without damage to the engine. Possible malfunction of automatic actuating system for the air inlet duct anti-icing equipment. Engine ingestion of foreign object, such as a bird, with or without damage to the engine. If stall and/or high EGT continues, suspect compressor damage. If during or following an acceleration, suspect possible airbleed valve malfunction, particularly if stall disappears after engine has stabilized and instruments return to Normal.	If the condition occurs when ice might form in the engine inlet, turn engine anti-icing system ON. An increased throttle setting and/or a slower airspeed will increase the anti-icing heat and decrease the rate of ice formation. Observe EGT closely to avoid exceeding the prescribed limits. The engine anti-icing system prevents the formation of ice and is not a de-icer. Under the most severe conditions, it may be necessary to change the aircraft altitude or locate atmospheric conditions that are relatively free of icing until the accumulation of ice has cleared from the engine air inlet. As soon as the engine commences to operate normally, the icing conditions may be safely re-entered. If a persistent stall occurs during or following acceleration and a stuck airbleed valve is suspected, reduce throttle setting and accelerate slowly. This may or may not be effective. **CAUTION:** If internal engine damage is suspected or if EGT or compressor stall cannot be controlled, land as soon as possible, using the minimum thrust required to sustain flight.
EGT too high, EPR lower than Normal, all other instruments approximately Normal.	Excessive airbleed from engine due to: (1) Overboard airbleed valve stuck open, or (2) Excessive leakage in the aircraft bleed system.	Anticipate a higher than normal fuel consumption for the thrust produced until the condition can be corrected. Reduce the throttle setting, if necessary, to avoid exceeding the allowable maximum EGT. If overtemp cannot be controlled, land as soon as possible.

Condition	Probable Cause	Action
Compressor stall during deceleration, often followed by a rumbling sound in the air inlet duct. Rise in EGT when condition persists.	Intercompressor overboard airbleed valves do not open during deceleration, due to: (1) Bleed governor schedule set too low, or (2) Bleed governor or bleed valve malfunction.	Increase airspeed to correct stall condition. Try switching to the emergency fuel system to control excessive EGT manually by the throttle setting. If overtemp cannot be controlled, land as soon as possible.
EGT near Normal or low. RPM, EPR and fuel flow low. Engine continues to operate.	Fuel control malfunction.	Unless the condition is serious, no action is necessary except at the pilot's discretion. Report circumstances on a Yellow Sheet.
Sudden drop in EGT, RPM, EPR and fuel flow. Complete loss of thrust.	Simple flameout, particularly when flying in turbulent air, resulting from upset airflow at the engine air inlet or within the compressor, itself. Flameout resulting from fuel flow interruption, possibly from running out of fuel. **NOTE:** Ignition operation should be for as short a duration as possible.	Attempt an airstart. If this fails, attempt an airstart on the emergency fuel system. Check fuel in tanks. Switch tanks, if necessary. Check position of emergency fuel shutoff valve. If cause was a simple flameout resulting from flying in turbulent air, try increasing the airspeed to prevent recurrence. Also, the ignition may be left ON for short periods until the turbulent area is penetrated. This will serve to relight the engine automatically, in some cases.
Abnormal oil pressure	If the oil pressure gage reading is too high: Oil strainer is clogged, Oil pressure relief valve is not bypassing. If the oil pressure gage reading is too low: Oil line failure, Oil seal or bearing failure, Oil pump failure. **NOTES:** (1) A fluctuating oil pressure might be caused by any of the above causes. (2) Although a high, low or erratic oil pressure is frequently caused by a malfunction of the oil pressure transmitter or the oil pressure indicator, it would not be safe to assume positively that this is the case.	Normal oil pressure is 40 to 50 psi for most engines. Refer to applicable NATOPS Manual. Oil pressures between 35 and 40 psi are undesirable and should be tolerated only for the completion of the flight, preferably at a reduced throttle setting. Oil pressures below normal should be reported on the Yellow Sheet, and should be corrected before the next takeoff (i.e, do not practice touch-and-go landings). Oil pressures below 35 psi are unsafe and require that a landing be made as soon as possible, using the minimum thrust required to sustain flight. **CAUTION:** If the oil pressure drops to zero and remains there for 15 seconds, or more, reduce the throttle setting to the lowest position required to sustain flight and prepare for the possibility of a seized engine within 2 to 4 minutes.

Since some of the procedures herein vary from NATOPS, consult the appropriate NATOPS manual to be absolutely correct—Ed.

POSSIBLE MALFUNCTIONS OF THE AFTERBURNER

Condition	Probable Cause	Action
As soon as the afterburner is selected and ignited, EGT spirals upward. EPR will also be high. The condition may be (but not necessarily always) accompanied by compressor stall.	Afterburner nozzle fails to open or does not open completely when the afterburner is selected and ignited. This might be caused by: (1) Binding of afterburner nozzle actuator pistons, or (2) Malfunctions of afterburner exhaust nozzle control (ENC).	Discontinue afterburning immediately by deselecting afterburner. If EGT exceeded the allowable limit, report the maximum temperature reached and the time that the temperature was overboard, on the Yellow Sheet. Although the nozzle might open successfully if another attempt is made to light the afterburner, extreme caution should be used to avoid damaging the engine.
Conditions similar to those above, except less pronounced. EGT and EPR high as soon as afterburner is ignited. The condition may possibly be accompanied by compressor stall.	Afterburner nozzle is slow to open after afterburner is ignited. This might be caused by: (1) Afterburner OFF and ON operation repeated too rapidly, (2) Afterburner exhaust nozzle control (ENC) malfunction, (3) Afterburner nozzle improperly adjusted.	If the afterburner has been used intermittantly, especially if a compressor stall condition has become aggravated by the afterburner having been repeatedly turned OFF and ON, allow more time between shutting down the afterburner and commencing the next afterburner relight. The interval during which the afterburner is OFF should be at least one minute. If the condition continues, further use of the afterburner should be at the discretion of the pilot.
Afterburner does not light after afterburner is selected. Condition will be noted by a lack of response of the aircraft and a sudden drop in EPR as the afterburner nozzle opens.	On J57 engines, fuel squirt from afterburner igniter and afterburner fuel flow from spray bars improperly timed, due to a drained afterburner fuel manifold. Afterburner igniter malfunction Afterburner fuel control improperly adjusted Burner pressure line from diffuser case to afterburner meter leaking (possible but not common)	After leaving the afterburner ON for 8 to 10 seconds, turn OFF for another lighting attempt. This technique gives good results because it changes the sequence of the igniter squirt and the afterburner fuel flow. The success of an afterburner light depends upon the igniter being timed to squirt when the afterburner fuel pressure in the manifold is increasing. If the squirt comes too late, the fuel/air ratio is too rich. If the squirt comes too soon, the ratio is too lean. When a fuel-circulating type of afterburner igniter is employed, the best recycling period between the first and second attempt to obtain a light is 3 to 5 seconds.
EPR too high during afterburner operation. Afterburner nozzle fully open.	Afterburner fuel control set too high. Malfunction of fuel pump transfer valve or transfer valve actuator	If prior to takeoff, abort or continue the takeoff at the pilot's discretion. If the afterburner must be used for takeoff, the takeoff should be made at reduced throttle setting, when possible, to maintain EPR within limits. If during flight, discontinue afterburning at the pilot's discretion.
Afterburner flameout in flight. NOTE: EGT and fuel flow will drop if afterburner nozzle remains in the open position after flameout.	An afterburner flameout in flight might result from any one of various causes, the most likely being incorrect fuel flow to the afterburner.	Try to relight the afterburner at a lower altitude and/or a higher airspeed.
EGT, EPR and fuel flow lower than normal after shutting down the afterburner.	Afterburner nozzle stuck in the open position.	Retard the throttle and then advance it again to the desired setting. This procedure will sometimes cause the afterburner nozzle to close. If the afterburner nozzle cannot be made to close completely, continue the flight at the pilot's discretion.

Ground Effect an old wives' tale?

by LCDR John T. Roderick, VP-40

"What is ground effect?" This is a question I asked a number of pilots in our squadron. The answers I received varied from "Does not exist" to a fairly accurate knowledge of what it is.

Summing up all the answers, it is the general opinion of the group that ground effect is "the added lift created by a compressing of the air and venturi effect when an aircraft is at an altitude equal to about one-half its wingspan." This article is intended to help clear up any misconceptions or old-wives tale theories in the minds of most of us. It applies mainly to those of us still flying the large reciprocators found in VP and VR.

Knowing how ground effect can help us, in an emergency situation where we must conserve fuel, may mean the difference between getting our airplane safely back from a long overwater flight or ditching at sea. There are many instances in the past where a pilot, after losing half the engines available to him, has used ground effect to conserve fuel, thereby making it back to a safe landing.

The pilots of turboprops and jets may find this article of interest, but at the speeds and altitudes at which they fly, they will not be using ground effect to conserve fuel in an emergency.

Ever wonder why your static ports were placed where they are on your aircraft? Let me explain without getting too involved or too technical. We all remember from the great green bible, "Aerodynamics for Naval Aviators," that IAS + ΔV_I = TIAS (the Δ in mathematical symbols means "change in"; therefore, ΔV_I reads "change in speed due to instrument error").

Then from the true indicated airspeed we throw in a position error (Vp which compensates for where we put the static port on the aircraft) and come with calibrated airspeed. TIAS + ΔVp = CAS.

Figure 1 shows how the position of the static port is determined. The arrows show the pressure pattern around the fuselage at optimum level cruise airspeed and angle of attack, at standard sea level conditions.

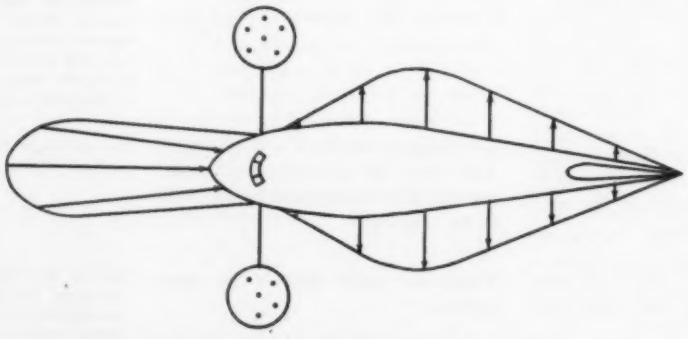

Fig. 1. Static ports placed where pressure is zero and Vp = 0

For a change in speed or angle of attack a change in Vp occurs (ΔVp). This is what we are interested in for the present. Figure 2 shows how ΔVp varies with TAS and angle of attack (α).

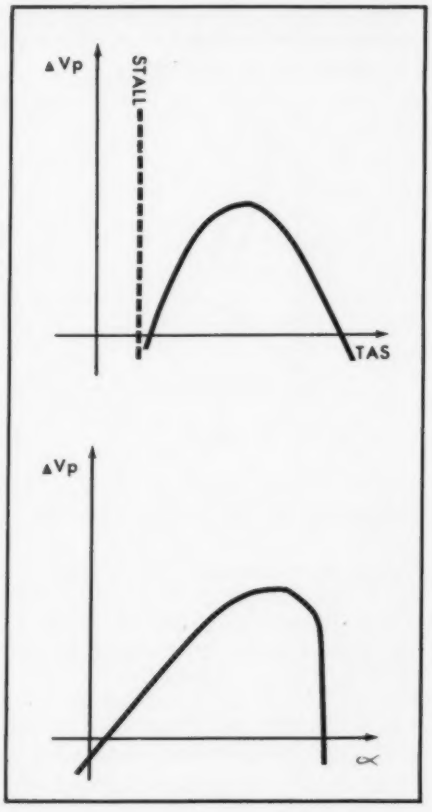

Fig. 2

The actual static pressure sensed at the static port may be different from the free airstream static pressure. At a speed near 100 kts a 0.05 psi position error is an airspeed error of 10 kts. As you can see this ΔVp is the difference between what you read on the airspeed indicator and at what actual TAS at sea level the airplane is flying. We'll get back to ΔVp later.

Let's talk a little about upwash, downwash, and wingtip vortices. At any prescribed angle of attack there is an upwash ahead of the wing and a downwash behind it. Let me quote directly from the manual. "If a wing is producing lift, a pressure differential will exist between the upper and lower surfaces. At the tips of the wing the existence of this pressure differential creates the spanwise flow components and, due to the forward motion of the wing, creates a vortex at the tip." The effect of this vortex system creates an upwash and downwash in the vicinity of the wing.

Now that we know everything there is to know about upwash, downwash, wingtip vortices and ΔVp, let's see what ground effect is and how it affects the flight characteristics of our airplane.

If an airplane is close to the surface (ground or water), there is a restriction placed on the vertical component of the flow pattern. The tail and fuselage aerodynamic characteristics are affected, but the principal effects take place in the wing characteristics. The upwash, downwash, and tip vortices are reduced when the wing nears the surface. This will cause a reduction in C_{Di} and α_i for a specific C_L. The closer the wing is to the surface, the greater the reduction in induced drag. The optimum altitude is equal to one-tenth the wingspan since nearly 50 percent of the drag is reduced at this height. Noticeable on takeoff and landing, this is what causes a floating effect just prior to touchdown. Figure 3 shows a comparison between coefficient of induced drag (C_{Di}) and the ratio of altitude (h) to wingspan (b).

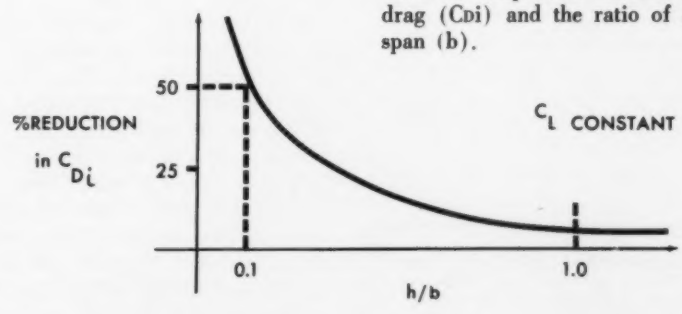

Fig. 3

Since the coefficient of induced drag is lower, a lower angle of attack can be used to maintain the same coefficient of lift (Fig. 4). Looking a little

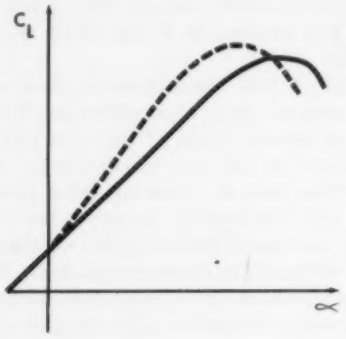

Fig. 4

farther we see that induced drag predominates at low speeds. If Di is reduced by ground effect, then the most significant reduction of thrust will take place at low speeds (Fig. 5). At high speeds where

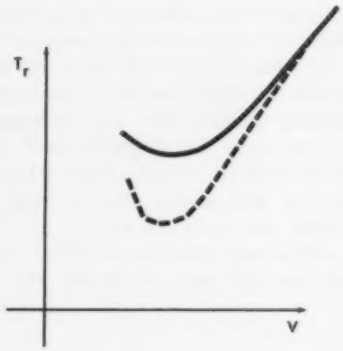

Fig. 5

Several articles have suggested that ground effect contributes to stalling. This is not the case. With the exception of the reduced longitudinal control power, ground effect is beneficial and does not contribute to unsatisfactory or unsafe flight conditions.

parasite drag predominates, and induced drag is a small part of the total drag, the ground effect causes no significant change in the thrust required.

Now back to ΔVp for a minute. Ground effect changes the slipstream and causes a difference in ΔVp. This in turn makes the altimeter and air speed indicator read lower, but your *TAS is higher.* Figure 6 depicts this graphically.

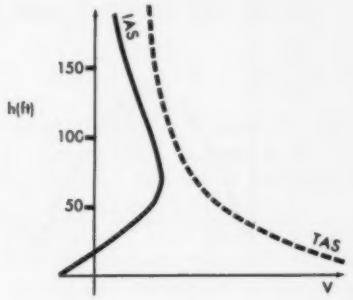

Fig. 6

Here is a summary of the aerodynamics changes that take place on an airplane flying through ground effect.

- Because of the reduced induced angle of attack and a change in the lift distribution, at constant attitude, an increase in lift will occur.
- The induced drag will be reduced but the parasite drag will be unaffected.
- The thrust required at low speeds is reduced.
- The reduction in downwash produces a change in longitudinal stability and trim. For a conventional airplane configuration ground effect will produce a nose down pitching moment.
- The ΔVp will change causing a lower reading in the altimeter and airspeed indicator than is actually taking place.

Now for a very important point. The *range* of a reciprocating powered airplane can be augmented by the use of ground effect. When close to the surface, the reduction of induced drag increases the maximum lift over drag ratio, (L/D) max, and causes a corresponding increase in range. *The use of ground effect to extend range should be reserved as a final measure in case of emergency.* Please reread that last sentence. In ground effect the reciprocating powered airplane will encounter a greater (L/D) max, which occurs at a lower airspeed and power required, and the corresponding increase in range is quite important during emergency conditions.

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How About You?

By Captain William J. Starr
Hq. 9th Air Force, Shaw AFB, S. C.

Once every three years, like all other pilots, I go to an altitude chamber and carefully learn what my symptoms are at the onset of hypoxia.* Mine are quite definite, always the same, and leave little doubt in my mind that I am hypoxic—when I'm in the chamber, that is.

Today, however, in a trusty old T-Bird, I got my symptoms again. As we leveled off at FL 240 (16,000 ft cabin pressure) I felt sick. My pulse was very rapid. I was breathing fast and there should have been no question in my mind that I was hypoxic. I automatically went to 100 percent oxygen, but that didn't help. In fact, I seemed to feel worse. Do you know what my next thought was? I thought we had contaminated oxygen.

I pulled my mask off my chin and tried breathing cabin air. No change. Then I made another brilliant deduction. I must be hyperventilating since I was breathing so fast. So I held my breath. The only trouble was, I couldn't seem to hold it for more than a few seconds. I thought that was very strange since I knew that when you are hyperventilating it should be easy to hold your breath for a considerable time.

While all this was going on, I had been responding to radio calls from the ATC center. I had made a frequency change involving setting up a manual frequency. I had even received and acknowledged a route change and repeated it to the pilot in the back seat, who had missed it.

Finally I decided that I definitely had some contaminated oxygen. I went back to normal oxygen and pulled the mask off my chin again, wondering if the transient crew had put nitrogen in our oxygen system. I wondered what other contaminant could have found its way into the oxygen which would be odorless, as I smelled nothing unusual. I debated calling our departure base to warn them of this potential killer they were passing out. But I never said a word to the jock in the back seat about my difficulty or about my conclusions. It never occurred to me that he was breathing the same oxygen as I.

Well, for some reason I started feeling better after a few minutes. I was very relieved and not just a little proud of the way I had solved the mystery. I was holding my mask off my face except when I had to talk on the radio. The back seat pilot was flying the bird all this time and I started checking radio frequencies.

A few minutes later, I very suddenly felt bad again. All the symptoms returned. I felt close to passing out, and loosening my mask didn't help a bit. At that point, finally, I thought of hypoxia. I checked my blinker—nothing. I took a deep breath—still nothing. 100 percent—still nothing. Finally, when I realized what was wrong, I reacted. I told the other pilot I was in trouble. I told him I was definitely hypoxic. (I guess I wanted to make sure he didn't get off on my tangent about contaminated oxygen.) I said something about descending and started pulling my bailout bottle handle.

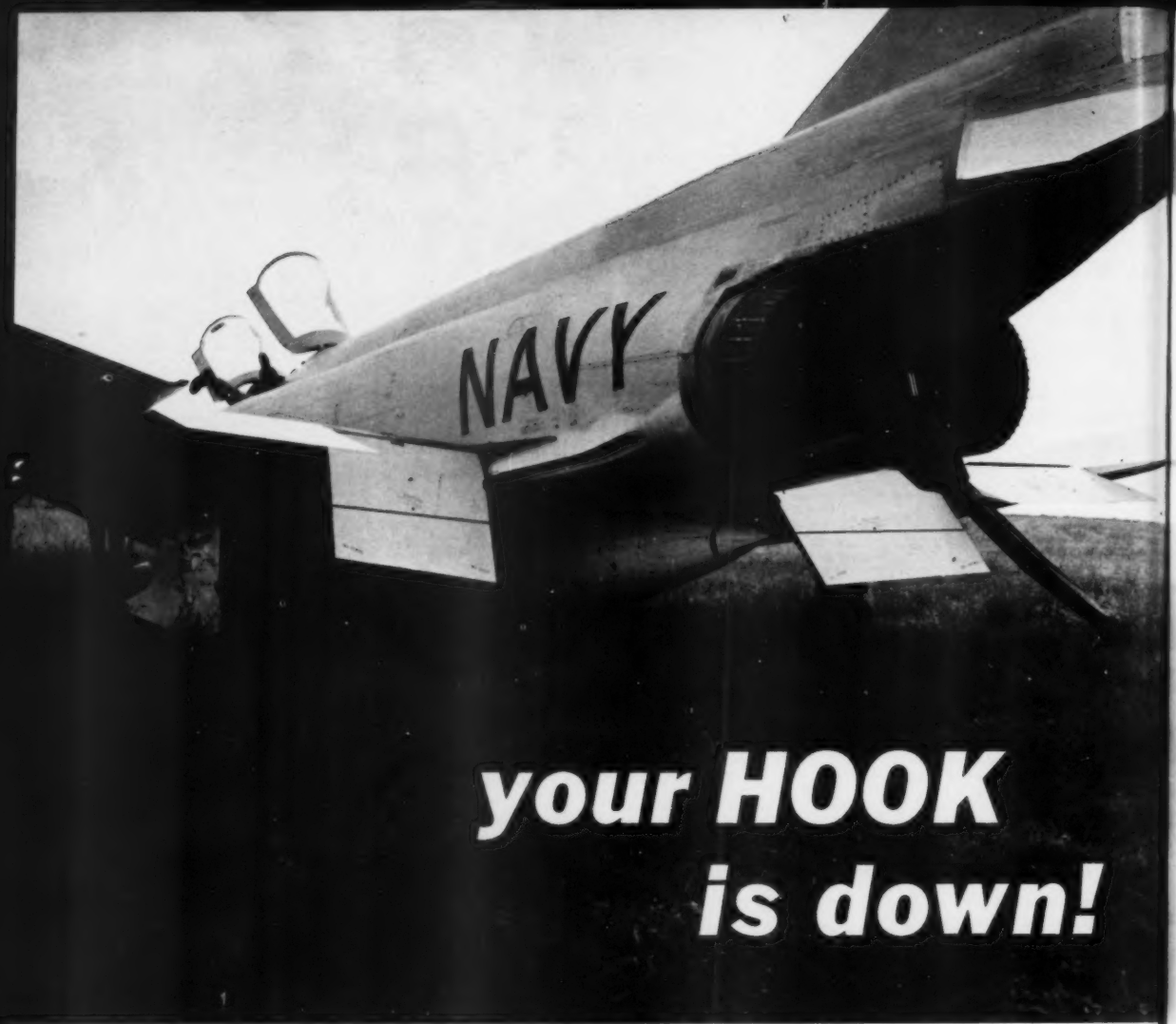
I started feeling better quite fast, although I think my vision was considerably reduced for a few seconds. We leveled off below 10,000 ft and I soon found the source of my trouble. The aircraft oxygen hose had pulled off a fitting down by the left side of my seat. I had checked my oxygen system prior to starting so I know the hose was connected then. I suspect the hose had pulled loose during a subsequent seat adjustment. Route changes, navaid troubles, clearance changes, etc., prevented me from noticing the malfunction during the 5000-ft and 20,000-ft checks.

So what is the point of this little tale? I have learned that I can experience all the symptoms of hypoxia, the same ones I have so carefully learned in the chamber, and never realize that I am hypoxic. I have learned that my judgment can be so severely impaired that I will remove my mask to avoid breathing contaminated oxygen but never mention it to another pilot using the same oxygen supply. I have learned that I can recover from hypoxia only to suffer a relapse far more rapid and acute than the original attack. Most important, I have learned that thorough and frequent oxygen checks may save my life.

How about you? Will you take my word for it or will you wait until you learn it the hard way?

—USAF Aerospace Safety, May 1965

* OpNav Instr 3740.3C requires Navy pilots to go through the chamber every two years.



your HOOK is down!

After ripping through the abort gear the *Phantom* plunged off the end of the runway and traveled 200 ft over the soft-composition overrun before pitching forward to an abrupt stop.

While booming in from the west on the last leg of a ferry flight the F-4 pilot spotted the field and called the tower for landing clearance.

"Roger Navy 345, you're cleared to enter downwind for runway 25. Call abeam with a gear check."

As the *Phantom* slowed and lined up downwind the runway glistened softly from the effects of a recent afternoon rain shower.

"345 abeam gear down, full stop."

"Roger 345 wind 060 at 3 cleared to land."

"How's the runway tower?"

"Runway slightly wet, no reported braking action."

"Is the midfield arresting gear up?"

"We can have it up in five minutes if you desire to hold over head."

"Negative. We'll try once. If we can't hack it we'll try for gear."

As the approach progressed the runway began to look wetter than ever, and to the pilot the thought of having gear available began to look like good insurance. After rolling into the groove he reached a decision.

"Tower 345, I'm going around."

"345 roger cleared downwind. We have a vehicle on the way over now to pick up the Morest crew. It should be manned within two minutes."

"345, I'll take it."

While proceeding around the pattern the pilot transmitted his proposed engagement speed (120 kts) and gross weight (34,000 pounds). The tower acknowledged and asked if he would be able to make a second go-around, "if necessary." The pilot replied that he would, since fuel was no problem.

"345 abeam gear down full stop."

"Roger stand by for possible go-around. Men approaching Morest this time."

"Roger."

"345 go around this pass."

"Roger going around."

The arresting gear was ready when the F-4 turned off the 180 on the third pass. Approach and touchdown was normal and on speed. Then matters began to get interesting.

On rollout the pilot elected not to deploy the drag chute in order to facilitate a waveoff if his hook missed the gear. About 500 ft short of the gear he moved the hook handle to DOWN. A few seconds later the *Phantom* rolled over the arresting cables with nary a pause and the pilot experienced, as he put it, "the profound absence of the arresting stop."

Jamming on military power he checked his speed and runway remaining and then broadcast his intentions to the RIO and tower.

During the acceleration, which seemed slower than expected, the tower operator transmitted twice that the hook was still down, but the F-4 crew didn't hear him. Just as the nose was starting up (about 140 kts) the pilot saw the chain abort gear flit by in his peripheral vision and immediately thereafter experienced a severe jolt and momentary deceleration.

Realizing what had happened he came back to idle and got on the binders in an effort to slow the aircraft in the scant 1400 ft of remaining runway. His braking efforts, although perhaps good for morale, seemed to have a negligible effect in slowing the aircraft. As the *Phantom* entered the overrun (native soil, not stabilized) it yawed left and then pitched forward to an abrupt stop as the nose gear collapsed. The occupants were not injured.

First let's take a look at the landing weight of the aircraft. After shutdown it contained 4000 pounds of fuel, 1200 of which was in the wing tanks. Figuring about 500 pounds consumed during each of three approaches, the pilot commenced his initial landing attempt with an estimated 5500 pounds of fuel aboard, or at a gross weight of 35,000 pounds. At touchdown on the third approach he was down to about 33,500 pounds gross.

A little heavy? You bet! the F-4 NATOPS puts it this way: "A wet-runway landing should be made at a normal landing gross weight of 31,000 pounds (approximately 2000 pounds of fuel remaining)." Certainly an emergency situation might justify landing heavy, assuming fuel dump was not possible, but such was not the case here.

Next let's consider the pilot's decision to hold deployment of the drag chute. In additional comment on wet-runway landings NATOPS says: "The drag chute should be deployed on touchdown and the flaps should be in the down position. Light braking can be initiated at 100 kts CAS." This procedure is considered optimum in that it affords the least chance for technique error by the pilot and offers the greatest number of retarding devices to aid him in effecting a safe landing.

The pilot's justification for holding the chute, i.e. to facilitate a go-around if midfield arrestment was unsuccessful, seems invalid since a deployed chute could have been jettisoned had a waveoff situation later developed. As a result of his technique, two retarding devices, the drag chute and the Emergency Field Arresting (abort) Gear were discounted. Had the fuel/weather situation been less favorable, his technique could have involved the grim possibilities of flameout during a go-around or reentry into an IFR traffic situation with a low-fuel state. Finally, his technique resulted in an inadvertent engagement of the abort gear.

Now we come to the problem of how to get the hook completely down before the aircraft has rolled beyond the arresting cables. The pilot states that he actuated the hook handle about 500 ft short of the arresting cables, using the thousand-foot markers for reference. In his estimation, based on prior experiences, aircraft speed and hook-extension time, this distance was sufficient to allow time for complete extension of the hook. Unfortunately his calculation was amiss. As the *Phantom* sailed past the No. 1 pendant the hook was still up, and it did not begin to drop until the aircraft was passing the No. 2 pendant. About 100 ft beyond the Morest it contacted the runway for the first time.

NATOPS recommends that the hook be dropped 1000 ft short of the arresting gear at speeds associated with a drag-chute deployment. In this case the pilot dropped his hook 500 ft (estimated) short of the cables at a speed in excess of that associated with a normal drag-chute landing. His estimated speed crossing the arresting gear was 100 kts. Considering that full hook extension requires 5 seconds, the pilot would have shortchanged himself even if he had dropped the hook sooner than he estimated—say

When the abort gear failed through overstress pieces of broken chain links were hurled in all directions, damaging C-130 in background and injuring a man who was standing in back of it.

700 ft short of the gear.

After missing the midfield gear the pilot stumbled again by electing to go around instead of deploying his drag chute, braking and taking the abort gear.

His waveoff technique was also questionable in that the hook was left down and maximum power (afterburner) was not utilized.

The abort gear was in battery and ready to go when the hot and heavy *Phantom* arrived on the scene, but it just wasn't designed to withstand the demands made upon it. The cross-deck pendant broke after picking up all the chain, and the ends of the chain whipped and propelled nine broken links over 4500 ft in various directions. One of these objects injured a man who was standing on the ramp. Other pieces of chain damaged a parked C-130, and hit an automobile that was located beyond the ramp.

A piece of broken chain link easily punched through the fender of this automobile after being propelled more than 4500 ft.

This accident could have been prevented. Its ramifications clearly point out the advantages of adhering to an established set of procedures that have been thought out and designed to handle a given set of circumstances. Knowing the procedures cold is a must, but equally important is the ability to recognize situations in which certain procedures apply. An effective way to anticipate and plan for most contingencies is to thoroughly brief the entire flight before takeoff.

Although it isn't feasible to have a standard operating procedure for *every* situation that one may confront, the procedures in NATOPS do provide the best available guidance in dealing with the unexpected, providing the pilot knows how and when to apply them.

Approaching the Check List Psychologically

by Chaytor Mason
Psychology Instructor
Aerospace Safety Division
University of Southern California

The check list is an aid to memory and is the only memory aid that we have at the present time that you can completely trust in times of stress or divided attention.

There will possibly be better ones in the future, probably along the lines of the Vips System or tape recorders but they are not here now and we still have to put the airplane on the ground without forgetting anything. Here is a method that insures the maximum possibility of success and the minimum possibility of failure.

Most slips on the check list are due to the fact that the person does not direct full time and attention to the items that he is responsible for. He is familiar with the order of the items and so when he comes to an old familiar one he says, "Oh yea, that one," and lets his eyes drift down the list until he regains consciousness or runs into a less familiar item. This we will tend to do no matter how well disciplined we are, especially if we are in a hurry and have other choices to do. How to avoid this error? This answer is to *involve the maximum amount of the body* in the conscious process of going down the check list. We must make sure that we miss no part of the list due to rush or the feeling of familiarity.

In order to exert the greatest amount of positive control over our own mind and to be at the height of our consciousness we approach each check list with this unvarying pattern: (1) Read each item out loud as it is written. (2) Look at each item whether it be a wheel handle or the airspeed indicator and repeat the check list instruction as you operate this control or read the reading of the instrument. Variation between the instruction and the reading will become apparent to you even if you are under great stress. (3) Touch each item mentioned on the check list. This, of course, will be done where a control is to be operated anyway; but in the case of instruments where under pressure we are likely to assume that everything is as it should be, this is another guide to assure that we will be fully conscious of our aircraft.

One of the greatest reasons for Check List Lassitude is fatigue at the end of the flight. We have been up for some hours and we want to go back to the ready room with as much dispatch as possible. Unless we stand over our own shoulder and monitor our actions these are just the circumstances that we will cork-off. That is the virtue of this method. You are in effect playing two roles. You are stepping outside of yourself to not only be the pilot, but also your own checkpilot as well.

As a matter of fact, this is why people talk to themselves, to increase the amount of attention that they can bring to bear on a subject and a monitor their own actions. It is to their credit that they do talk to themselves rather than fall victim to confusion. Wherever the individual is under stress from noise, worry, aging, confusion or other demands on his attention or from partial loss of consciousness due to fatigue or injury, he can improve his performance by this simple rule of Say, Look, Touch.

If you talk to yourself and begin hearing answers, then you have learned well.

the double failure

By LT James E. Fannon Jr.

What is a double failure? A double failure is simply the failure of the back-up system to function after the primary system has malfunctioned. The following experience is an example of a double failure in an E-2A.

The pilot arrived at the squadron two hours before the scheduled takeoff time. The mission was to commence at 2200 and last for five hours. He met his copilot and together they checked the weather. The weather was forecast to be CAVU for the next 12 hours. A DVFR flight plan was filed and the pilots returned to complete their final flight briefing.

The rest of the crew consisted of a Combat Information Center Officer (CICO), Air Control Officer (ACO), and Radar Operator (RO). The mission—radar evaluation. After completion of the briefing, the yellow sheets were checked, and preflight completed. All previous gripes were signed off and the airplane was accepted.

The takeoff and climbout were uneventful and both the copilot and pilot constantly searched the sky for other aircraft. After one hour they arrived on station.

The controlling aircraft checked in and the main part of the radar mission began. The autopilot was engaged. The pilot's primary task was to maintain station position. This task plus monitoring the aircraft systems and watching for other aircraft occupied the pilots for the next three hours. The pilot also monitored the operation of the crew conducting the radar evaluation. Everything was going as scheduled. The airplane was performing perfectly. All instruments were steady and in the "green."

Finally, the CICO advised that the mission was completed. The time was now 0200, and the aircraft was turned toward home base. The sky was clear, the stars were shining and the moon was bright. Repeated weather checks with home base assured the crew that the rest of the flight would be quite routine.

Thirty miles from home base a VFR penetration was commenced from flight level 200. The lights of the base were in sight. There was little reported traffic. Radar was put in "stand-by." All required checklists were complete. The final landing checklist remained.

Passing through 18,000 ft the pilot noticed the primary hydraulic system gage fluctuate and at the same time the CICO reported hydraulic vapor in the equipment compartment. The hydraulic system gage now indicated zero pressure. The aircraft completely filled with hydraulic vapor. Immediately the pilot switched to 100 percent oxygen, opened ram air vents and depressurized the aircraft by opening the dump valve. This increased the airflow throughout the aircraft. The concern now was the possibility of a leak in the oxygen reservoir located in the equipment compartment. The spraying hydraulic fluid seemed to be the heaviest in the equipment compartment.

The fumes soon cleared and the aircraft was leveled at 10,000 ft. The radar operator checked the equipment bay and reported which hydraulic line had broken. He also reported the secondary hydraulic system was full and operating normally. The first portion of the emergency was over. The pilot then thought of the emergency systems which must be activated to land the aircraft. With the primary hydraulic system inoperative, the landing gear must be lowered with a 3000 psi air bottle system. The flaps must be lowered using the backup electrical system. The brakes had to be switched to the alternate system using reserve accumulator pressure.

Over the field he informed the tower of the emergency and prepared to lower the landing gear. Reducing airspeed to gear extension speed, he activated the secondary system. The starboard gear came down and indicated locked. The nosewheel came down and indicated locked. The port gear indicated UNSAFE. Unfortunately, the secondary landing gear extension system is a one-shot affair. Now what to do? First, he flew over the runway and had a visual check made of the gear. The port gear was in the trail position. He applied "G" to the aircraft to lock the unsafe gear. This procedure worked! The gear now indicated DOWN-and-LOCKED. Another visual check verified all gears were down-and-locked.

The landing was made with no difficulty. A later inspection of the failed systems disclosed a cracked hydraulic line and a cracked B-nut fitting on the 3000 psi air bottle system.

A double emergency requires pilot skill and proper technique to prevent a possible accident. A pilot must be familiar with "normal" emergency procedures and also be prepared for the complex emergencies. He must know his aircraft. Luck and superstitions can never replace skill and science. Know what you are going to do after the secondary system fails. The life you save may be your own.

Short Snorts

Teamwork

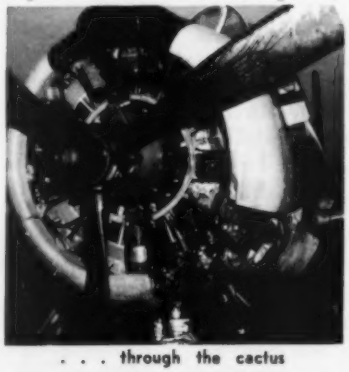
The tranquility of a VFR airways flight at 4500 ft was suddenly shattered by a loud "bang" and a "thump." Erratic engine performance (T-28) in the form of much missing and popping immediately followed.

The pilot noted a drop in MAP from 28 to 21 inches, but all other engine instruments remained normal. In an effort to smooth out the engine he put the mixture control to RICH. This didn't seem to help so he decided not to move the prop and throttle controls, fearing the loss of all power.

Since the commotion up front seemed to be intensifying, it was time to start looking for a place to set 'er down. The desert terrain ahead looked about as good as any on the horizon, so the pilot set up a glide while his partner in the rear seat radioed their situation and intentions to the nearest flight service station. While thus engaged the copilot was also trying to spot an abandoned air field which he knew was somewhere in the vicinity of their location.

As the T-28 approached the selected landing site the terrain began to look less suitable, even for a wheels-up landing, than it had appeared from altitude. Just before touchdown (100 kts, full flaps) the pilot spotted a small gulley and bank of sand in the landing path. In a last-minute effort to clear this obstruction he shoved up the prop control and jammed on full throttle while the copilot applied steady prime.

The engine banged and missed worse than before but did supply enough additional power to initiate a waveoff. During the pullup the aircraft smashed through the top of a tall cactus (see photo)



. . . through the cactus

but managed to continue a slow climbout.

During the struggle for altitude the copilot sighted a water tower which he recognized as being near the abandoned air field that he had been trying to locate earlier. The pilot decided to try to reach the field, even though the engine sounded like it would quit at any moment.

Enroute the engine continued to cut up and steadily lose MAP. Oil streamed over the port wing. But the pilot managed to maintain at least several hundred feet above the terrain all the way and subsequently made a successful gear-down landing at the air field. The engine gave a final sputter and quit during the rollout.

When the engine had first started acting up the pilots thought they had struck a bird, but no evidence of such collision could be found. The only damage to the engine that could be detected during the initial inspection was attributed to the collision with the cactus. Cause of the original engine malfunction remains unknown pending the results of a DIR.

Drugs

Self-Medication or the taking of medicines in any form by flying personnel without medical supervision is extremely hazardous. Even simple remedies which are obtainable without prescription, such as aspirin, anti-histamines, cold tablets, cough mixtures, laxatives, tranquilizers and the

like, may seriously impair the fine coordination and concentration required in flight.

A standard rule for flying personnel should be: Take no pills or medicine unless prescribed or approved by the flight surgeon.

Quotable

"Conformance with . . . Good Operating Practice is not as simple as it sounds. It requires constant attention to innumerable details and a deep-seated realization that additional hazards incident to flight operations exist whenever vigilance is relaxed."

Lightning Strikes

Despite radar and other aids, a few pilots stumble into thunderstorms each year . . . most will escape with little more than a rough ride. Others will encounter heavy rain, hail, lightning, or all three—and find themselves flying a damaged aircraft.

If you are unfortunate enough to join the latter group and your bird is struck by lightning, be sure to cross-check your compass against the VOR or tacan course selector bar. The strike can magnetize parts of your bird and throw all mag compass systems 'way out of kilter. Remember this, react accordingly, and don't compound your problems by trusting a confused compass.

—TAC Tips

Hydraulic Line Failure

As the flaps were being raised following takeoff the pilot of the SP-2H noted a rapid loss of all normal system hydraulic pressure, accompanied by illumination of the main hydraulic system low-pressure warning light.

Flap movement ceased at four degrees from full up. Inspection of the radar well revealed a one-inch break in the 3000-psi hydraulic pressure line between the engine-driven pumps and the main system accumulator. The entire fluid contents of the normal hydraulic system had been pumped into the radar well.

The pilot extended the landing gear by NATOPS emergency procedures and executed a landing without further incident. He brought the aircraft to a stop on the runway through use of differential reversing and emergency brake.

The 3000-psi hydraulic pressure line had failed in fatigue at a 90-degree bend just prior to the point where it was connected to the main system accumulator. There was no evidence of maintenance error.

Runway Near-Miss

Sequence of events:

CG aircraft was issued taxi clearance by FAA tower on ground frequency. Clearance acknowledged. VFR flight.

Commercial aircraft taxied out at same time.

Both aircraft reached ground position clearance limits simultaneously.

Tower cleared commercial aircraft to takeoff on one runway and it was observed to begin takeoff roll.

Fifteen seconds later CG aircraft was observed taking off on another runway.

Tower ordered commercial aircraft to hold position. Both aircraft aborted. No contact.

What Happened?

A simple case of misinterpreting call signs. Ground Control had answered the CG aircraft's original call with "Coast Guard 8346" but used "346" and "46" for the rest of its transmissions. The CG pilot was communicating on UHF, not listening VHF; hence did not hear commercial aircraft's side of communications with tower.

The airliner, call sign "Seagull flight 460," was only on VHF, of course, and his call sign, too, was shortened after the first call-up.

Here's what the CG pilot heard just before he pushed the throttles up:

"four six hold short—landing traffic 23 right"

"four six taxi into position and hold"

"four sixty cleared for takeoff"

Some of the details of this incident are not clear but the message is. Be wary of shortened call signs, particularly when aircraft with similar call signs are also in traffic, air or ground. And monitor or use frequencies being used by the great majority of the traffic at a particular airport. It may be noisy but you'll be better informed.

Filing of IFR Flight Plans

The current practice of filing route information in an IFR Flight Plan by the use of airway or jet route numbers is creating an air traffic control problem. In the future FAA will require pilots to reflect the following when fill-out a flight plan:

- Enter enough information to clearly indicate the proposed flight path
- If more than one airway or jet route is to be used, indicate points of transition
- If the transition is made at an unnamed intersection, show the next succeeding navaid or named intersection on the intended route and the complete route from that point.

Example: ALB J37 Atl J14 BHM, indicating transition to J14 at Atlanta; or ALB J37 J14 RIC J14 BHM, indicating transition to J14 at unnamed intersection prior to Richmond.

—Adapted from USN Notice to Airmen

Woodchopper

While on standby for SAR we got the word to launch two H-34 helos for a downed pilot pickup. Upon the alert, my leader and I sent our crews and copilots out to the aircraft while he and I briefed as best we could. When plotting the available bearings on the chart we realized we would be going north to a classified area.

After getting airborne and on course we soon made contact with our cover aircraft and flew into the pickup area with no trouble. Upon reaching the crash scene we spotted the open chute of the downed pilot and made radio contact with him on his survival radio.

The situation dictated a hoist pickup. The pilot was standing on a tree limb about 80 ft from the tree tops and about 100 ft above the ground. As the hoist in the leader's helo was found to be malfunctioning, I was told to go down and attempt the pickup.

Because of the altitude, about 3000 ft, the leader cautioned me to watch my rotor turns and I made my approach so as to leave enough room for a hover over open terrain.

I gradually slid into position so I could drop the hoist. Upon reaching zero kts indicated I stopped the rate of descent to check my hovering capability. Using about 2700 turns and 47″ MAP I had no rate of descent but was drifting slightly left. The downed pilot was on the leeward slope of a ridge and about the time I put in cyclic control to stop the drift we hit the downdraft of the ridge.

We picked up a rate of descent. I wrapped on a few more turns and went to 48 inches, which was max power. I couldn't stop the sink rate and my turns started falling off so I lowered the collective to regain the turns, but that just increased the rate of descent.

We were soon hitting tree foliage but I remembered a small ravine to my left and I decided to try to keep it flying. Reaching the ravine area I lowered the nose to regain speed. I guess we went down about four or five hundred feet into the ravine (trees above us on both sides) until there was enough airspeed for recovery.

The aircraft suffered blade damage on all main and tail rotor blades from hitting the trees, and there were a couple of gouges in the fuselage to boot.

We pulled up to altitude and vectored in two turbine choppers to make the pickup then departed for home and repairs. Possible prevention could have been to check maximum power available. I didn't realize I could draw 48 inches and that extra bit might have helped if used soon enough. Also I could have gotten rid of a 300-pound raft that we had in the belly. Lastly I could have made sure I was hovering for my check instead of keeping my sideward motion.

(*For more information on wind flow see* APPROACH, *October, 1965*)

ANYMOUSE

The purpose of Anymouse (anonymous) Reports is to help prevent or overcome dangerous situations. They are submitted by Naval and Marine Corps aviation personnel who have had hazardous or unsafe aviation experiences. As the name indicates these reports need not be signed. Self-mailing forms for writing Anymouse Reports are available in readyrooms and line shacks. All reports are considered for appropriate action.

—REPORT AN INCIDENT, PREVENT AN ACCIDENT—

Heads Up!

The weather for our 1045 takeoff was 800 overcast with four miles visibility in haze, and forecasting 1000 scattered with six miles in haze. We launched on an instrument departure and rendezvoused on top at 20,000.

Clearance was received to operate in A.P.C. from FL 300-330 for 1+00 and we had just headed in that direction when I lost both transmitter and receiver. I signaled my wingman and promptly passed the lead.

An uneventful tacan and GCA was accomplished with field contact coming at 900 ft.

At this point my wingman advised radar that I would land on the initial approach and he would turn downwind. Unbeknown to him, however, I had decided to continue upwind past the tower and then enter downwind, in order to allow additional time for dumping fuel. On the base leg my attention was directed toward the tower in hopes of spotting a light signal, but I did notice that my wingman, who had taken interval, had cut inside and was headed perpendicular to the runway at my altitude. Upon reaching the 45 and still seeing no light from the tower, I decided to look around. Sure enough, I was not far from the parade position on a GCA-controlled F-4B. Both of us waved off.

In retrospect, it's plain to see that:

- Continued emphasis must be placed on increasing lookout doctrine at all times.
- Tower operators must alert all concerned aircraft when a no-radio aircraft is present.
- A re-evaluation of communication between tower and landing pattern aircraft, and tower, radar and IFR aircraft is needed to insure that towers have 100 percent control of all aircraft in their zones at all times.

Airspeed Out

Nearing the end of a night cross-country from Olathe in a T-33, I was approaching the Chicago area with plans for a radar letdown and handoff to NAS Glenview and GCA.

Upon reaching "round lake" fix, I was transferred to Chicago Approach Control (360.8) who cleared me to flight level 240, and shortly thereafter cleared me for a radar letdown on a heading of 090 degrees. Prior to leaving FL 240 I turned on my windshield defroster and pitot heater.

Shortly thereafter I was cleared to descend to 2500 ft and upon reaching that altitude I leveled off. It was not long after I leveled off that my airspeed indicator unwound to ZERO. I continued to fly by attitude and predetermined power settings, meanwhile notifying Chicago Approach of the situation. They asked if I wished to continue the approach and I replied "affirmative."

On the first GCA to Glenview I was unable to see the runway and executed a missed approach, climbing back to 2500 ft on a heading of 360 degrees. I was directed back to Chicago Approach on 306.2 but with the difficulty of flying without an airspeed indicator and the additional difficulty of illuminating the radio control box with a flashlight in order to reset the frequency, I ended up on frequency 360.8. I notified Chicago that I had waved off, and they directed me to switch to 306.2.

There followed vectors for another GCA, but again I did not sight the runway—and again I executed a missed approach. Shifting to approach I requested an ASR at Chicago O'Hare. It was granted but I did not see the runway on the first attempt, and neither did I see anything on the second pass. My fuel state was now critical with about 70 gallons (or about 10 minutes flying time).

Upon waveoff from the second approach at O'Hare, the illumination from the field below enabled me to notice that I had quite a bit of ice on my wings. Thinking this was strange I asked what the surface temperature was and got the reply, "51 degrees." It wasn't until this time that I realized that I had leveled off from my initial descent at 12,500 ft instead of 2500 ft, having misread my altimeter.

Thereupon, I notified Chicago that I was at "10,000 ft," and they subsequently cleared me down with close vector for another shot at O'Hare. I sighted runway 32 at about 4 miles out and got clearance to land. Upon turning off the runway the gage indicated 40 gallons remaining.

I have nearly 5000 hours first pilot time, and about 2000 hours in the T-33, but misreading the altimeter by 10,000 ft can and did happen to me. I don't remember accurately, but I believe I was given a frequency change to 306.2 during my initial descent from FL 240. In our T-33 aircraft, the radio control box is located aft on the right console panel, and in order to see the tuning dials, it must be illuminated by a flashlight, while using the other hand to change frequencies.

This procedure takes both hands away from control of the aircraft and necessitates a 90-degree shift of scan away from the instrument panel. I believe this interruption of flight instrument scan during the descent was a contributing factor in my misreading of the altimeter.

Reader Questions Headmouse Answers

Have you a question? Send it to Headmouse, U. S. Naval Aviation Safety Center, Norfolk, Virginia 23511. He'll do his best to get you and other readers the answer.

Sticky Problem

Dear Headmouse:

Recently I replaced a laminar seal in an A-13A oxygen mask. The mask was air dried for a period of 12 hours before returning it to the pilot. A couple of hours later he went on a mission and experienced a severe headache. He had to abort the mission. The headache was attributed to the glue used for replacement of the seal.

I have read somewhere that it requires one hour for the glue to be completely dry and ready for use. I submit that a minimum of 24 hours be required when replacement of the seal is required. This is the time limit now being used by this squadron with no recurrence of the above problem.

JACK CRESON, PR1
VA-113

▶ We have had a similar report in which a pilot encountered difficulties after a "glue job" on his oxygen mask. (See April, 1966 APPROACH, Letters to Headmouse, "Glue Jag," page 22.)

The type II adhesive prescribed in NavWeps 03-50B-503 as Mil-A-5092 (Aer) superseded by Mil-A-5092B 30 Dec 63 is the correct adhesive to use when replacing the laminar face seal on the A-13A oxygen mask.

The one-hour drying time you recall was in BACSEB 8-55 (cancelled in November, 1957) and was for a different type of adhesive. NavWeps 03-50B-503 is the only publication currently in effect which covers this subject other than the MilSpecs.

Mil-M-6482C of 30 May 1965, the Military Specification for pressure breathing oxygen mask assemblies, states: "*Bonding procedure* —The number of coats of adhesive and the drying interval between coats shall be as specified by the manufacturer. The adhesive shall not be thinned. All bonding operations shall be conducted between 75 and 80°F., and at a relative humidity between 50 and 65 percent. The strip adhesive specimens shall be thoroughly buffed and cleaned with toluene before applying cement. The specimens shall be air cured for 24 hours at 75 to 80°F., and a relative humidity of 50 to 65 percent."

Very resp'y,

Headmouse

Navy Policy on SCUBA

All personnel who have been engaged on a recreational or line of duty basis in SCUBA or any other type of diving utilizing underwater breathing apparatus at depths exceeding 30 ft (or who have been exposed to equivalent pressures in excess of this depth in a recompression chamber) should not fly to cabin altitude higher than 18,000 ft (or make decompression chamber ascents above this altitude equivalent) within 12 hours following the termination of such a dive or recompression chamber descent.

—*Aviation Medicine Division, Bureau of Medicine & Surgery*

5-Day Safety School

Dear Headmouse:

An article appeared in the February issue of APPROACH titled "LT. A. V. Safeoff Goes to a 5-Day Safety School". Is there such a school and, if so, is it possible to obtain quotas?

J. A. DRAKE, JR., LT
NAMDDU, PANAMA CITY, FLA.

▶ The Naval Aviation Safety Center conducts a five-day Aviation Safety Officers' School at the Naval Air Station in Norfolk, Virginia.

The course is a five-day program of instruction involving about 35

hours of classroom time with a curriculum similar to that described in the article. In reality, the course is an interim measure to better qualify officers in ASO billets who have not attended the course at USC or Monterey.

Quotas for the NASC workshop are assigned to the listed commands and they are requested to allocate the quotas to fleet and shore-based squadrons, aircraft carriers, air stations, training and reserve squadrons, and reserve training units and detachments, as appropriate, under their command.

The commands are: CNATra, CGMARTC, CGFMFLant, CGFMFPac, ComPhibLant, ComPhibPac, ComNavAirLant and ComNavAirPac.

The next, tentatively scheduled, class begins on 9 August 1966. Quotas will be issued about six weeks in advance, by speedletter.

Very resp'y,

Headmouse

Knife on Mk-5A

Dear Headmouse:

For those mice experiencing difficulty in finding a suitable place to carry their survival knife on their Mk-5A, I offer my method: Observe, both ends have elastic bands. The upper band will slip through the belt slots whereas the lower band must be sewn to the scabbard itself. The upper band should be made from 1½" elastic and the lower from ½" to 1" elastic. Any pararigger should be able to locally manufacture this item.

HENRY W. DIXON, LTJG
SURVIVAL OFFICER, VF-32

▶ Your method of carrying the survival knife on the Mk-5A anti-exposure suit was reviewed with interest here at the Safety Center. Basically, it looks like a good idea which should not damage the anti-exposure suit. The local survival people, however, point out that there is a possibility in this configuration of the knife hanging up on something during emergency evacuation of the cockpit. For this reason, they recommend the addition of a pocket for the knife and case with elastic webbing attached as in your photo.

This is VRF-32's method of carrying the survival knife (below the knee, either leg) when wearing the Mk-5A anti-exposure suit. A pocket for knife and sheath would make configuration more hang-up-proof.

Very resp'y,

Headmouse

Anti-G Suits

Dear Headmouse:

Whatever has happened to the Z-3 anti-blackout G-suit? We parachute riggers (pardon me, aircrew survival equipment men) noticed to our dismay that this very popular skeleton style G-suit has been deleted from the Section H Allowance List (NavWeps 00-35QH-2).

According to Section H, VF and VA pilots should wear the Z-2 modified anti-G suit when not wearing the full pressure or anti-exposure suits. But, from our experience, fighter pilots shun the Z-2 modified like the *plague!* They just do not like it and would rather fly sans the anti-G suit than wear that Z-2.

WONDERMOUSE

▶ A call to the Aviation Supply Office in Philadelphia verified the following information: There are no more Z-3 anti-G suits. The Z-2 was deleted by CNO OP-506F/VJC letter, Serial 6081P50 of 15 July 1965. The Mk-2 anti-G suit with adapter (MS-17966) will become the Mk-2A. The NavWeps 00-35ZH-2 Allowance List should be changed to show the Mk-2A anti-G suit as the standard item to be used with the full pressure suit and the anti-exposure suit, and with the summer flight coverall when the anti-G suit adapter is attached. The anti-G suit adapter should be listed and identified as a necessary item in order to utilize the Mk-2A anti-G suit with summer flight coveralls. There are plenty of Mk-2A anti-G suits in stock at this writing.

Very resp'y,

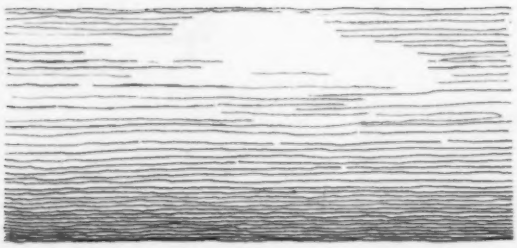
Headmouse

Swimming Qualifications

In the July, 1965 *Approach*, a letter to Headmouse requested clarification of the requirements for swimming tests for aircrewman qualification. The Safety Center investigated and on its findings that specific swimming requirements were not specified in detail in current OpNav Instructions, submitted a recommendation to CNO that such requirements be standardized.

OpNavInstruction 1510.4E of 10 Jan 1966, *Qualification and designation of Aircrewmen*, states that all aircrewmen must qualify as second class swimmers as defined by BuPers Manual, Article D-2502: "A prerequisite to qualification as swimmer, second class, is successful completion of test for swimmer, third class. To become a swimmer, second class, a person must enter the water, feet first, from a minimum height of 10 feet and remain afloat for 10 minutes. During this time he must swim 100 yards and use each of three strokes for a minimum distance of 25 yards. This swimmer is classified as one who can 'take care of himself.'"

10 RULES fo

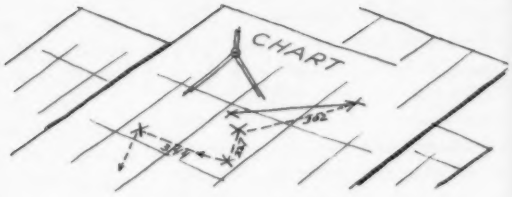


DO NOT CONTINUE A LOW LEVEL FLIGHT IN MARGINAL WEATHER

The greatest danger occurs in marginal weather over rolling, hilly terrain. (Everyone is careful when hills become mountains.) If it were solid soup, you would have already gone home. When it's marginal, there is a tendency to press on with the hope that the weather will improve. Flying low level around hills in marginal weather is like Russian roulette; most of the time you win. But losing is a disaster.

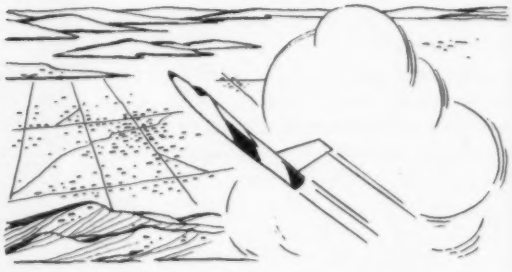
DO NOT TURN ON TIME ALONE IN THE HILLS OR MOUNTAINS

Normally, if you fail to identify a turning point, you would turn on ETA. NOT IN THE HILLS OR MOUNTAINS. This faux pas could lead you up a box canyon if you were deceived by a similar checkpoint. This possibility was a suspected cause of an accident in USAFE last year. You must be positive of the turning point when flying around mountains or hills.



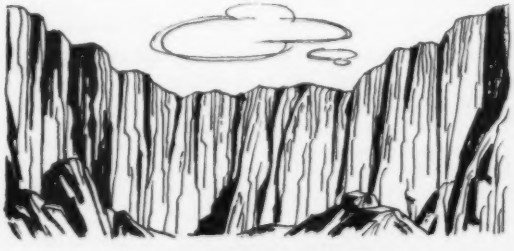
PLAN EVERY LOW LEVEL FLIGHT METICULOUSLY

Use current charts. Fly the routes in the direction prescribed. Flying them backwards ups the midair rate. Memorize the target run. Plan the flight; fly the plan.



CLIMB, IF YOU BECOME DISORIENTED

Plot a navaid near each leg in case you have to climb for orientation. It's a good procedure to plot navaids for your entire low level route and then use them to assure accurate navigation. If you cannot climb to 1500 ft above the ground in VMC (visual meteorological conditions) then start your 180 immediately.



PLAN ESCAPE ROUTES

Check the terrain on both sides of each leg and decide ahead of time which way to turn if the horizon disappears.

for safe, low level flight

FLY LOW OR SLOW, NEVER LOW AND SLOW

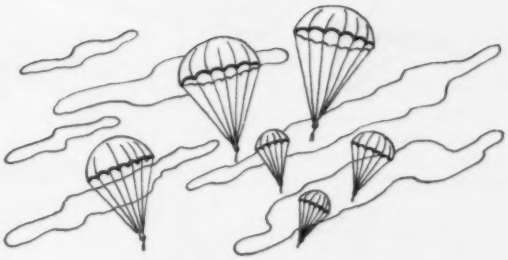
There is safety in speed as well as altitude. Higher speeds will give you the option to zoom in an emergency. Don't box yourself into a tense situation with neither speed nor altitude.

MONITOR THE ALTIMETER

Altimeters have been noted by aircrews to be wrong by as much as 2000 ft. Always get a target area altimeter setting from the forecaster. If you get another one in the target area, ask him if it's a QNH (station pressure corrected to sea level) or a QFE (actual height above terrain). If you have a radar altimeter, cross-check it.

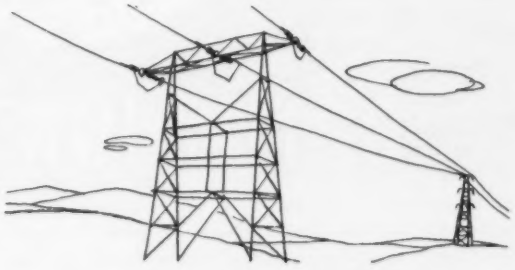
LEAVE LOW LEVEL ACROBATICS TO THE DEMONSTRATION TEAMS

Even they practice for weeks at altitude before they slowly lower their routine. Low level flight requires more attention to details than the high level version.



CHECK THE NOTAMS

Some parachuting areas are reserved for continuous use. For example, hundreds of Frenchmen skydive at their local airports on weekends and holidays from early spring to the late fall. This is one reason why low level flights are prohibited over France on Saturday afternoons, Sundays and holidays. Know the drop zones in your local area. Avoid gunnery and artillery ranges unless you are doing the shooting.



BE ALERT FOR THE UNEXPECTED

Have your maps ready before descent. Keep folding to a minimum. It's better to have a few maps and number them. Be alert for runaway trim. Watch out for uncharted towers and their guy wires. River valleys are often crossed by invisible cables. There are many glider fields in Europe; even a near miss can be dangerous to a glider, or to a light Army aircraft. Fly with your helmet visor down whenever conditions permit. Impact with birds has shattered the windshields of many Navy aircraft. In some cases, visors have saved the pilot's eyesight.

—Adapted from Airscoop.

COMPLICATED RESCUE

An F-8E, following an uneventful catapult shot, flamed out at 400 ft. After two unsuccessful relight attempts, the pilot pulled the face curtain. Ejection altitude was approximately 200 ft. Full parachute deployment took place at 75 ft. He landed in the water just at the edge of the geyser caused by the crashing aircraft.

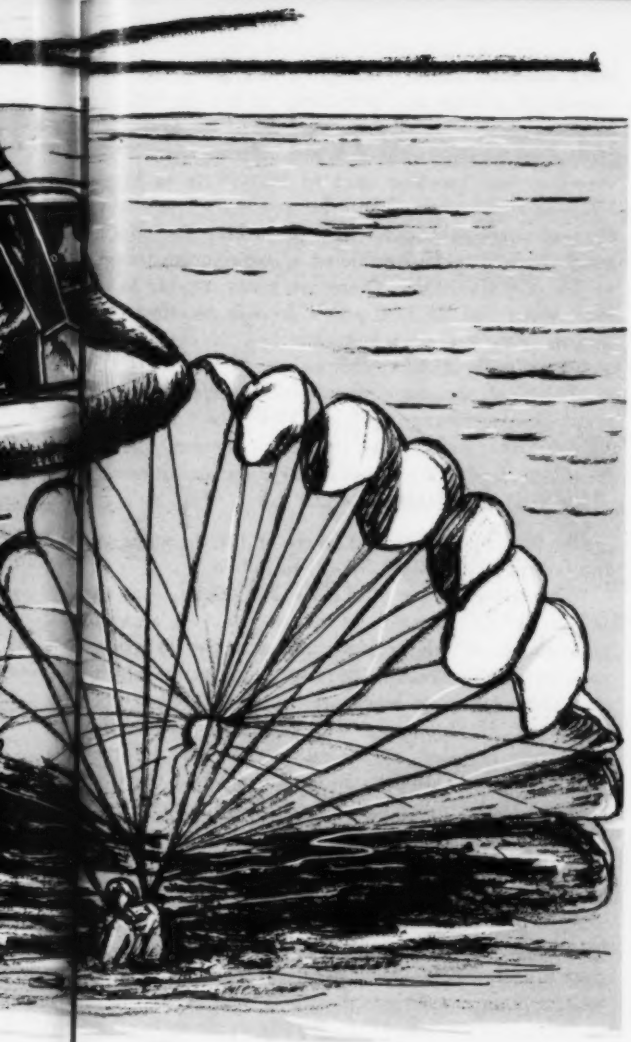
"The shock of the ejection was what I had always expected it would be," the pilot stated later. "I saw my knee board go flying off, recognized one tumble, saw the seat hit the water and then I hit."

The rescue helo proceeded up the starboard side of the carrier and arrived overhead less than a minute after the crash. By this time the F-8E pilot was already involved in one of the most complicated jet pilot survival and rescue stories reported in many a month. . . .

Sea state was slight with three-foot waves and a 10 kt wind. Immediately on entering the water, the pilot released his left rocket jet fitting. His leather flying gloves had become slippery in the water and he was unable to release the right fitting. He tried to pull his gloves off but they were new and fitted snugly. He then pulled the right toggle on his Mk-3C life preserver but the chamber did not inflate. (The reason for this will be discussed later.) He could not find the left toggle.

By this time the helicopter had arrived overhead and had lowered the three-pronged rescue seat.

"The crew was motioning for me to get away from



the chute," the pilot states. "I backed away as far as I could and mounted the seat. The chopper started to pull me in at this time but the chute started to blossom and he had to drop me back into the water to get away from it. When I went back into the water, my legs were right in the parachute shroud lines."

Hoist Difficulties

Meanwhile the helo crewman controlling the hoist had been having troubles of his own.

"As the seat entered the water," the crewman stated later, "I realized for sure that the pilot's parachute was not disconnected. The pilot immediately grabbed for the seat and held on for all he was worth since his flotation gear was not inflated. I tried to let out more line but the switch broke loose from the control handle to which it is mounted. Thus the pilot was pulled half out of the water due to the uplift of the plane and his chute started to billow. I finally remounted the switch in its holder and started to lower more cable but I had the switch in backwards, thus raising him up even further." (The crewman then corrected his error.) "I then pushed the switch in the down position and he again submerged. . ."

While the pilot was still suspended in the air, the whipping and billowing wet parachute wrapped around him and tied him to the seat.

"At this time," the hoist crewman's narrative continues, "the second helo crewman realized it was necessary to go in the water. He got the Chicago grip and tried to fasten it to the cable, but with no luck. He then decided to jump. He went in with his life vest inflated and swam towards the pilot."

In the water, the crewman's foot became tangled in the trailing shrouds. After freeing himself he swam behind the pilot and tried to find a way to free him from the parachute. Because the parachute and shrouds were wrapped around the pilot's legs and body down below the surface of the water, the crewman could do little to cut them free. Keeping the pilot's head above water was all he could manage. He removed the pilot's oxygen mask and signaled the helo pilot that he could not detach the chute.

Chute Billows Again

The parachute began to billow again and the helo pilot had to move the aircraft around to keep from deploying the chute entirely. By this time the chute was so hopelessly entangled with the survivor and hoist cable that the decision was made to raise the survivor to the helo with the chute. Because of the tangle he came up in a horizontal position, his feet on the rescue seat and his hands gripping the cable about three feet above the hook.

"As the survivor rose," the hoist crewman states, "he assumed a horizontal position. At the time I didn't realize how. As he ascended to the level of the hatch I grabbed the rescue seat which was facing toward the plane and started to pull him and the seat in. At the same time I let up slack to pull him further." (This, the flight surgeon reports, converted the pilot's horizontal position into a vertical, head down position.) "I put my foot up against the door and pulled with all I had but with little success. I then motioned for the photographer passenger to help. While we were pulling him in, the pilot's hands slipped from the cable but I grabbed his wrist. His gear and chute were so wrapped around him and the

seat that it would have been very hard for him to fall off. His drogue chute was billowing and causing drag so I cut it away with my knife. We finally maneuvered him inside the helicopter after a tedious fight. . . He seemed to be in a great state of shock."

"By this time I was so exhausted that I could barely move my arms," the pilot recalls. He had been in the water seven minutes.

Return to Carrier

With portions of the pilot's main chute streaming out of the helicopter hatch and along its starboard side, the helicopter returned to the carrier and landed on the flight deck. Except for a mild muscle strain of his back, probably due to forces encountered during ejection, the F-8E pilot came through his ordeal uninjured. The helo crewman who was left in the water after the pilot's rescue was picked up by a second helicopter.

The Accident Investigation Board and endorsers to the AAR discussed the helicopter rescue with realistic understanding of a complicated situation resulting from many interacting factors.

"The rescue helicopter crew made a successful rescue and are to be commended," the AAR states. The Board considered, however, that the helicopter crew unnecessarily complicated the situation by being so quick to lower the seat into the water. (It was the hoist crewman's first rescue.)

"It is of the utmost importance to ensure that the survivor is separated from his parachute prior to attempting to lift him from the water," the board wrote. "When the helicopter first appeared on the scene, the survivor was swimming on his back away from the parachute. If the helo (crew) had determined that he was still connected to the chute it is felt that the second crewman should have been put into the water to assist the survivor in freeing his second rocket jet fitting. This fitting was later found to operate freely and it is felt that if this had, in fact, been done, the survivor would not have become entangled in shroudlines since he would have been free of a billowing chute. Such a procedure would have made the pickup a routine matter and the billowing chute would not have endangered the rescue helo. This rescue could easily have ended in a tragedy directly traceable to the survivor's still being connected to his parachute."

Praises Rescue Team

"The pilot quite possibly would have drowned if the helo rescue team had not been upon the scene so quickly or conducted the rescue as it did," the third endorser states. "The pilot had given up the attempt to release the remaining rocket jet fitting. He was unable to remove his gloves or find the remaining toggle switch for his inflation gear and therefore was exerting most of his efforts to keep his head above water. The helo crewman's entry into the water and subsequent struggle to keep the pilot's head above water is considered a contributing factor to the pilot's survival. There are many aspects to a helo rescue and the helo pilot's decision to effect the pickup with the parachute attached is considered sound under these circumstances."

(The Koch parachute release fitting [reference Aircrew System Change 41] and the new polyamide fabric/leather flying glove [Personal/Survival Equipment Crossfeed 5-65] should help reduce such survival difficulties in the future.—Ed.)

The Board commented at length and to the point on the failure of the pilot's Mk-3C to inflate.

"The failure of the pilot's Mk-3C flotation gear to inflate by the actuation of one toggle is a serious consequence of this accident and a matter of grave concern to the Board. Survival equipment which does not work is so much useless weight and is not deserving of the name. Investigation of the life preserver revealed a dented diaphragm on the carbon dioxide cylinder which the pilot had tried to actuate. The cylinder had too few threads to permit it to be screwed into a position where it could be actuated."

Cylinder Inspection

The squadron submitted an Urgent Ampfur on the unsatisfactory cylinders. Since this accident, Interim Clothing and Survival Equipment Bulletin 14 (BuWeps message 031803Z of August 1965) prescribes a one-time inspection of these cylinders to screen out all those having less than eight threads.

Among the Board's recommendations were:

- That all users of Mk-3C flotation gear carefully screen their supply of actuating cartridges to preclude the use of unsatisfactory cartridges with insufficient threads to properly position the cartridges.
- That all rescue helicopter crews be apprised of the possible advantages of taking enough time to properly evaluate a rescue situation and to ensure, if at all possible, that a pilot is separated from the parachute prior to commencing a lift.
- That pilots must be reminded that with engine failure below 1500 ft and 250 kts they are not obligated to attempt a relight and shall eject immediately.

How's Your Memory?

Adapted from AVIATION PSYCHOLOGY, Aviation Safety Division, University of Southern California, by Nicholas A. Bond, Ph.D.; Glenn L. Bryan, Ph.D.; Joseph W. Rigney, Ph.D.; and Neil D. Warren, Ph.D.

You, the man, are the weak link in aircraft operations. At least that is what we hear quite frequently. Along with this statement sometimes come conjectures and theories as to what you would look like if you were designed solely to operate an aircraft. These stretch the imagination even to picturing the ideal aviator as a human computer with a physique of a multi-appendaged ball.

In a sense, you were designed to be an aviator. From the "raw materials" available, you were selected as having adequate intelligence and coordination, much as the airframe designer selected materials for their strength, weight, and ductile or brittle characteristics. Then your behavior was modified through training and experience, depending on your capacity for retention and application.

You depend upon your memory quite a bit. Normal procedures are memorized for smooth, efficient aircraft operation. Vital items which must be accomplished immediately in the event of a malfunction, or cautions to be exercised, are all memory items.

Yet, the human memory is fallible, as evidenced by the number of personnel error accidents when maintenance personnel forget to connect or lock wire an assembly or pilots forget to lower the landing gear. Where possible, human memory is backed up by check lists, but even these are at times forgotten. Why?

What Is Memory?

In its simplest form, memory is the capacity to delay responses. Hundreds of thousands of items can be stored in your mind during a lifetime. But only a few of these items are accessible at a time and many cannot be voluntarily recalled. Although human memory has a greater capacity than a computer, it does not provide the same on-demand storage source, or instant recall. In fact, many items are actively repressed from recall even though they are retained in the individual's memory.

Remembering

The mental act of bringing items to consciousness from your inactive memory storage is called remembering. There are three different applications of remembering pertaining to aircraft operations. These are recall, recognition and savings.

Recall is rote recount of items committed to memory and has many applications to flying, such as memorization of emergency procedures. Yet, recall is extremely unreliable for such important tasks. A study of a large number of aircraft accident histories revealed that emergency procedures were necessary in almost 95 percent of the cases studied. Some emergency procedures were used in about 85 percent, but in over half of these cases the procedures used were incorrect. Further, there was no correlation between experience level and correct emergency action. The study did support the contention that increased flying time in the preceding months reduced the accident potential at all experience levels. For low-total-time-pilots (up to 500 hours total jet experience), increased time in the model aircraft reduced the rate drastically. Pilots with less than 50

hours had an accident rate three times that of pilots with 100 hours total time in the aircraft.

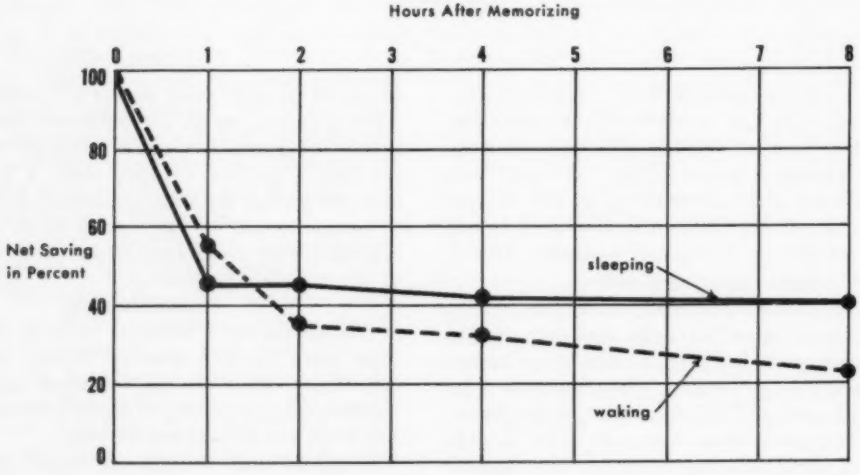
Recognition is usually a more sensitive method of remembering. Generally you can recognize far more material than you can recall. This is the principle of standardized procedures such as lowering landing gear on base leg or some other specific point in an approach. You recognize your position in the pattern and correlate it with the physical act of lowering the landing gear. The person who executes a precise pattern is less likely to forget a step than the one who "thinks for himself" and continuously varies his procedures.

The flight simulator realizes an important advantage in this respect. It substitutes recognition associated with definite physical actions in combating an emergency for less reliable recall of verbally learned procedures as they would be simulated in an aircraft.

that forgetting could have been part of the problem. Of course, it is uncertain whether initial proficiency was balanced between the groups with low and high recent flying time.

Laboratory experiments in verbal learning and retention show that the fine edge of skill or verbal recall decreases rapidly without practice. You possibly experimented along this line yourself in cramming for final exams or "brushing up on NATOPS" just before a flight check. This may have produced a good grade or impressed a flight examiner, but in the long run you are walking on quicksand. Numerous personnel-error accidents have involved crew members who received fine comments on their last proficiency check.

Most of this crammed verbal learning is forgotten within an astonishingly short period, as shown in the accompanying chart. Over half of verbally-learned material is forgotten within one hour, with a long



A period of sleep (solid line) immediately after the learning session results in slightly longer retention of verbally learned material of small meaningfulness.

Savings applies to relearning. One example would be the flight simulator refresher course. Even after you no longer are able to recall or recognize something, a part of it is retained in your memory. A second learning generally is easier and quicker than the first, and more likely to be retained. This also has adverse effects which will be discussed later.

Forgetting

Understanding the facts of remembering somewhat requires an examination of the converse—factors which cause forgetting. The study previously cited, relation of accidents to monthly experience, suggests

range retention of only about a quarter.

This chart also depicts another phenomenon, the effect of activities following the learning period. This is what the aviation psychologist terms retroactive inhibition. Basically, any experience following the learning period interferes with, or covers up, remembering the material learned. Surprisingly, the greatest effect is found when the subsequent experience is exposure to material similar to that just learned. You tend to remember the newer material which may be slightly yet significantly different. This is substantiation for restricting aircrews to currency

in one model aircraft. As shown by the dashed line, the least forgetting occurs during sleep. . . .

Sustaining Proficiency

If you examined the chart, you're probably wondering about the validity of either the graph or the principle as you think you remember most of what you learn from day to day. The answer to this lies in the two most important factors in learning: continual use and the meaningfulness of the material. The extensive experiments which provided data for the graph were conducted with material which was of small use to the subjects. Many of the things you learn in connection with the operation of your present aircraft have a meaningful relationship to aircraft you flew in a previous assignment or during pilot training. Also, you use this information from day to day, relearning it again and again and thus making it easier to recall. The fine points or items of infrequent use are the ones that will escape you. On this basis, material studied in NATOPS should be in inverse proportion to the amount of daily use. For a staff officer maintaining currency in late-model aircraft this probably includes everything between the covers.

Habit Interference

Another barrier to your memory occurs when there is a reversal of control displays with regard to the more familiar. This can be in the arrangement of switches and controls between the aircraft you are presently flying and the models flown previously. Or it can be as simple as interference between units on an instrument panel. This occurs when one instrument is arranged in a "fly to" display and the next reads "fly from." A common example is the course indications on an RMI versus the magnetic compass, or the pitch indications versus the top bank indices on an altitude indicator. Such interference slows down cross-check and reduces efficiency.

The same applies to the flight engineer's panel when one gage reads clockwise and another counterclockwise, or when controls are reversed on different models.

For example, the engine controls on a C-124 and a B-50 are in reverse order. Another example resulted in loss of an aircraft. Shortly after takeoff the pilot experienced buffeting and was unable to maintain altitude. The aircraft was ditched four miles from the takeoff point. The flight engineer had most of his experience in, and was also current in, another aircraft in which the cowl flap switches worked in reverse of those on this aircraft. Instead of closing the cowl flaps, he opened them, causing buffeting and drag.

In a reversal of the phenomenon (retroactive inhibition) discussed previously, the older habit is remembered in preference to the recently learned one. An important factor which aggravates the memory process is that most aviators do the majority of their learning during their early years in flight training and their first mission aircraft. Once established as "old heads" they feel less need to study and really learn the new aircraft. Habit interferences are just "poorer systems than we had back on the old so and so." This means that remembering will require a good deal of active forgetting. Stop reminiscing about the reliable "old" airplane and concentrate on the more reliable "new" one.

Influencing Your Memory

In conclusion, there are several factors you can apply to help control your memory.

- *You'll remember best the things you learn thoroughly.* Don't confuse inadequate training with lapse of memory. If you never really learned the procedures, it isn't right to say you forgot them.
- *You remember what you want to remember.* Attitude and approach will determine the amount you retain.
- *You remember vivid, unusual or emotional experiences.* This has two effects. It may firmly implant a procedure in your memory or, if it was a frightening experience, it may produce a phobia and a conditioned response which is the converse of the correct procedure.
- *You remember meaningful patterns.* This helps accomplish items in precise sequence, but a step can be omitted if you are distracted during the sequence. A "360" on base has often resulted in a gear-up landing.
- *You remember only a few things at a time.* Recognition and association can be used to trigger a memory sequence, but recall will be in serial fashion rather than in a flood of memories.
- *You normally remember recently-learned material best.*
- *Your activities following a study period will affect the amount of material remembered.* Physical practice aids retention. This can be applied to the length of class periods. Don't spend too long a time on one particular subject or aspect or you won't remember material learned the first part of the period.
- *You remember best that which you use often.* You need to remember most the emergency procedures which you use least often. Study them frequently.

You, the man, don't need to be the weak link. Make your memory work for you. Remember?

Notes from your Flight Surgeon

Tropical Land Leeches

A number of requests have been received at the Naval Aviation Safety Center for information on methods of repelling land leeches. These small parasites are common in the rain forests of Southeast Asia. They are especially troublesome during the monsoon season.

Land leeches reach the human host from foliage and grasses or they may climb up a person's legs from the ground. Once aboard, they quickly find openings in the clothing and reach the skin where they attach themselves by suckers. The anterior sucker contains the mouth which is fitted with small cutting teeth used to pierce the skin of the host. When the skin has been pierced, the leech secretes hirudin, an anticoagulant which facilitates bleeding. The animal engorges itself with blood, then drops off the host.

The bite of the leech is painless and persons are often unaware that they have been bitten. The only medical problem concerns secondary infections which may arise at the puncture site, especially since these lesions are slow healing. Some individuals develop an allergic reaction and experience severe itching at the lesion site.

Land leeches are easily removed by pulling them off, touching them with a lighted cigarette or applying table salt, or gasoline, vinegar or any other strong solution. They can be repelled by using the standard stock insect repellent (FSN-6840-753-4963). The repellent should be applied liberally to all exposed skin. It is also wise to apply it to the waist and legs. Your flight surgeon by referring to BuMed Instruction 6250.10 can give you additional information on the use of the repellent.

Flight Deck

"BECAUSE of the everpresent problem of man-power shortage aboard our carriers resulting in longer work hours for personnel and considering that flight deck operations had been intensive in the preceding days, the possibility of fatigue as a factor in this accident is a real one. (*The accident involved a plane handler trying to free a chain caught under an aircraft being respotted. The chain tensioned, he was tripped and the main mount ran over his foot. —Ed.*) Men who are tired and overworked are prone to cut corners and get sloppy in the accomplishment of their routine tasks. In an area as hazardous as the flight deck, intelligent caution, discipline and attention to details must be maintained at all times. A tired flight deck crewman is an accident waiting to happen."

—Flight Surgeon in MOR

Strobe

A model 4F strobe light was instrumental in the location of a pilot down in the water on a dark winter night last year. The pilot of aircraft immediately overhead located the survivor as soon as he turned the strobe light ON. The light was so brilliant that it was readily seen by a fighter pilot at 30,000 feet.

"The strobe light's use was a prime factor in LTJG—'s rapid location and rescue," the investigating flight surgeon reports.

Leg Burns

AN A-4 ejection was completely successful in all respects except for first degree burns received by the pilot on the back of each leg. At the time of ejection, the pilot was wearing the two-piece fatigue type combat flight gear without the anti-G suit. As a result of the ejection, the rocket motor blast blew the pilot's pants legs up, allowing the rocket exhaust gases to burn his legs. Had the fire retardant flight suit and/or the anti-G suit been worn as prescribed by NATOPS, it is unlikely that any injury would have resulted.

—NavAirPac Weekly Accident Advisory 31-65

Signals

A TF-9J pilot ejected successfully over water. He attempted to remove his parachute harness but was unable to do so completely because of injuries incurred in the ejection. His right leg became entangled in shroudlines.

A helicopter arrived on the scene and dropped a hoist. The survivor

beckoned for a crewman to come down and help him, but the crewman did not understand and stayed in the helo. With difficulty the survivor managed to mount the hoist and was lifted into the helo while still attached to his chute. During the recovery the parachute billowed dangerously close to the rotor blades. The crewman cut the chute loose after the survivor entered the helo. The chute again billowed and almost tangled in the rotor blades.

"Once again," the investigating flight surgeon writes, "we have the problem of how to communicate between a survivor in the water and a helicopter above. The implications are obvious; signals should be set, known, and used if at all possible."

Unlearned

"THE Board considered the pilot's actions subsequent to ejection. During the parachute descent, the pilot released *both* lower rocket jet fittings, thereby losing the seat pan, bailout oxygen bottle, and survival kit. This action may have been initiated with a thought towards preventing any further back injury as he descended through the trees. In view of the thickly wooded area he landed near, the possibility exists that the seat pan and kit could have been lost, possibly at a time when it might have been needed.

"After landing, the pilot located the seat pan and began to extract the life raft and survival kit in an attempt to locate a flare with which to signal the helo. The pilot was unable to extract the raft because of unfamiliarity with the required procedure. This action also raises the question as to whether or not the pilot was aware of the signaling devices contained within the Mk-3C life preserver he was wearing.

"The pilot feels that the excitement and confusion attendant to the ejection possibly caused him to react in a somewhat confused manner. The Board only notes this action in an endeavor to continue to stress the importance of survival training which so familiarizes the pilot with his equipment and procedures that his reactions during this type of situation become automatic."

Cuts Lines

A pilot whose survival gear was attached to his survival vest with parachute shroudline accidentally cut it away while freeing himself from parachute lines in the water.

NASC Comment: Tie your gear with any suitable cord as long as it is *not* the type 3 shroudline used in parachutes (because of the obvious possibility of unintentionally cutting the line in the water). In addition, survival goodies should be enclosed in the survival vest pockets.

Preflight Seat

SOME F-8 pilots have not been checking the timed release mechanism trip rod fastened to the after bulkhead of the ejection seat. Because it requires certain gymnastics to sight the after starboard side of the seat, this item is sometimes overlooked. This is particularly true in cold weather when the pilot is trying to hurry. The low altitude capability of the ejection seat is negated if this mechanism does not function properly.

—MARTC Bulletin 3750

Protection

Survivor of S-2E water crash: "I retained my helmet throughout the entire affair until I was on the deck of the submarine. Initial inspection of the helmet revealed several places where I could have experienced moderate to severe skull/facial injuries had my helmet come off. The chin strap was tight during the impact and the period in the water."

Visor Up

THE pilot's helmet sun visor was not lowered prior to ejection. After rescue, it was noted that the visor cover was cracked in two places along its upper border. After the visor cover was removed, a gouge caused by a hard blow on the screw of the visor knob was found. There was no actual break or crack in the helmet proper.

The fact that the pilot does not recall a blow to his head, along with clear evidence of a fairly severe blow to the helmet, indicates that the helmet served him well. The pilot's only injuries were superficial bruises of the shoulders and mild low back discomfort.

(*The helmet visor should always be lowered before an ejection. See next item for a tragic case in which failure to do so resulted in severe injuries.—Ed.*)

Visor Up Again

IN an ejection from a jet airplane which was out of control, a pilot was severely injured and will probably be physically impaired for life. This might not have occurred had he been flying with his visor down. At the instant of ejection, one hand slipped off the face curtain handle and the wind blast caught under the front edge of his helmet and rotated it backward. As a result of head buffet, the after edge of the helmet struck the pilot in the nape of the neck and dislocated a vertebra, damaging the spinal cord. This can occur even with the chin strap and oxygen mask cinched up tightly, but with the visor down snugly on the oxygen mask, it is much less likely to occur.

The Role of Quality Control in 3-M

Now that a number of outfits are under the 3-M (Maintenance and Material Management) control system some of the bugs have come to light. This article directs attention to the functions and possible malfunctions of the quality control division operating under the 3-M system.

Quality Control is still required to function as outlined by the current BuWeps 4700.2 series instructions even though some of the sources of information (URs, Work Orders, etc.) have been replaced by the 3-M system. Under the system the Naval Aviation Maintenance and Material Management Manual warns that local procedures must be established to provide Quality Control with information necessary to perform its functions and responsibilities. Some sources of information are: completed Maintenance and Production Control work center registers, processed maintenance data report (MDR) forms, daily status reports and analysis reports.

One point that should be made clear is that Quality Control does not guarantee the end maintenance product. The supervisors and technicians actually responsible for the work also have the basic responsibility for quality inspections. Quality Control's responsibility is, generally, to sample the results produced by the supervisor and his technicians. This increases the probability of high-quality work, and uncovers possible errors. Sampling, rather than complete end-items inspection, is necessary in order to achieve the maximum utilization of QC personnel.

Here are three areas in which the maintenance officer can concentrate his efforts to improve the effectiveness of his Quality Control function.

1. *The maintenance manager's approach.*
2. *Personnel assignment.*
3. *Operation of the Quality Control function.*

Our philosophy and recommendations for proper Quality Control utilization follows.

Improvements in the Maintenance Manager Mode of Operation

The most important act that the maintenance officer can perform to improve the quality of maintenance is to adopt "Quality Maintenance" as his theme and basic policy. The "Zero Defects" program and other quality projects should be encouraged and fostered as additions and "extras" to this basic policy. Operationally-ready rates, maintenance man-hours per operating factor, and other management control items *must be subordinated to quality.*

The maintenance officer should clearly spell out his policies with respect to the Quality Control function. These policies should be in writing, either in directive or memo form, and should be fully understood by the Quality Control Officer and his personnel. The requirements for Quality Control action that should be specifically defined include:

- Type and frequency of inspections to be performed.
- Local requirements for QC response to aircraft emergencies and ground incidents/accidents in the maintenance complex.
- Responsibilities of Quality Control with respect to foreign object damage.
- Requirements for Quality Control inspection and verification of maintenance action documentation and maintenance data reports.

A wise maintenance officer uses the quality inspection reports. They pinpoint areas where attention or action is desirable and will eliminate potential problems before they crop up. Review of these reports by the maintenance officer will increase his knowledge of conditions within the entire maintenance complex. Additionally, he should require a monthly summary/analysis/recommendations report from Quality Control on observations made during the previous month.

Disputes are certain to arise now and then, when one man is judging the work of another. The maintenance officer should always decide in favor of quality maintenance when differences of opinion occur, even when it hurts production temporarily.

The Quality Control Section can be a useful troubleshooting agency. The maintenance officer, however, should consider the effect on the normal workload before assigning numerous troubleshooting projects to Quality Control.

Improvements in Personnel Assignment

If Quality Control is to function as intended, only the best qualified maintenance personnel should be assigned to these duties.

A thorough review of the authorized and actual manning is another step that can improve the personnel situation. The authorized manning document should be examined for adequacy in numbers, grades, and specialties to properly perform the assigned mission, and action should be taken to correct shortages. The maintenance officer should attempt to fully man the Quality Control Section with the proper grades and specialties and to insure adequate stability and continuity in personnel positions.

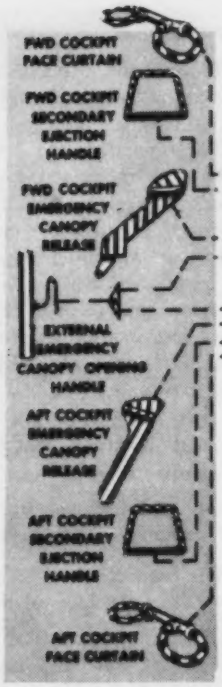
Improvements in the Quality Control Mode of Operation

The following suggestions are designed to improve the Quality Control section's effectiveness.

- For maximum utilization, organize the QC function in accordance with the basic principles of management.
- Plan for a high percentage of scheduled inspections and an evenly distributed QC workload.
- Hold over-the-shoulder spot checks to a minimum. They duplicate a basic responsibility of the maintenance supervisor, and do not increase the individual's pride in his work.
- Complete and detailed checklists should be maintained. They should be used by QC personnel to the maximum extent possible.
- Insist on impartial, objective, and well substantiated inspection reports being accomplished in a professional manner.
- Insist that the QC function maintain exact files of master work cards and technical publications.
- Provide time for QC personnel to maintain their files. They must keep current on the latest technical information applicable to their jobs.
- Require good records-keeping of both actions taken and of technical information.

Local problems and peculiarities of the mission may require some deviations from this approach. Regardless of the situation, however, any efforts expended in improving the Quality Control function will yield increasing returns throughout the entire maintenance organization.

—Adapted from USAF "Maintenance"


FWD COCKPIT FACE CURTAIN
FWD COCKPIT SECONDARY EJECTION HANDLE
FWD COCKPIT EMERGENCY CANOPY RELEASE
EXTERNAL EMERGENCY CANOPY OPENING HANDLE
AFT COCKPIT EMERGENCY CANOPY RELEASE
AFT COCKPIT SECONDARY EJECTION HANDLE
AFT COCKPIT FACE CURTAIN

HANDLE with CARE

There's Only ONE SLIP Between SKILLED and KILLED!

Cockpit Checkouts for Line Crews, Too!

WHEN an F-4 returned from a late afternoon flight the plane captain installed only the face curtain safety pin in each cockpit, closed the canopies and hurriedly left for chow. He planned to return after chow to complete his post-flight inspection and reservice the aircraft.

Meanwhile, a freezing rain began falling so the duty line crew was ordered to move the F-4 into the barn. A crewman, unfamiliar with the *Phantom,* opened the canopy and crawled into the cockpit to ride the brakes. Because of the rain he partially closed the canopy. Once in the barn he realized he did not know how to open the canopy from the inside. In the dim light he noticed a black and yellow handle. He moved the handle and a low hiss was heard —luckily, the canopy did not jettison.

The reporting safety officer noted that this incident spotlighted two glaring omissions:

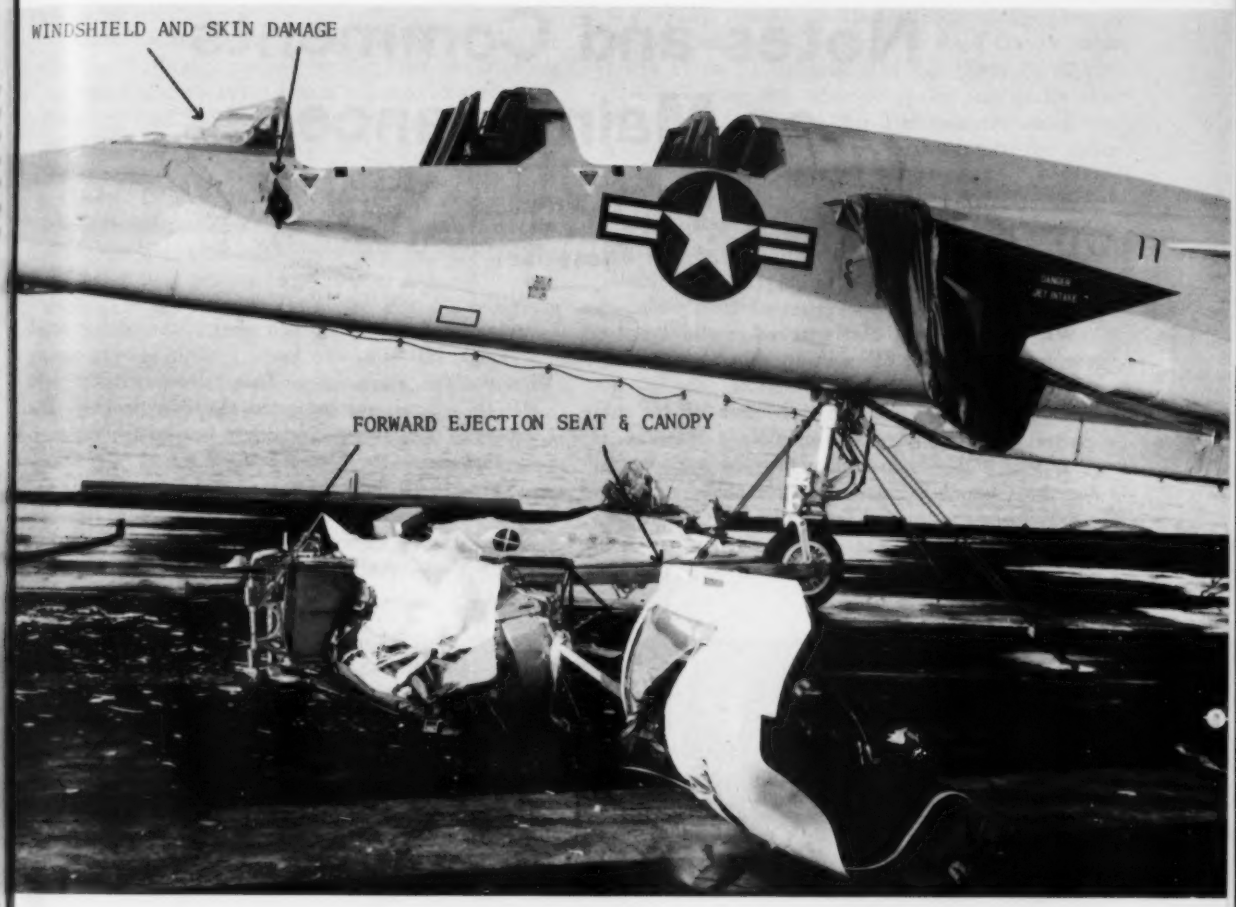
- The plane captain should have installed all of the safety pins.
- The brake rider should have had a complete cockpit checkout.

The incident also gave rise to these questions concerning cockpit checkouts:

- Would you sit in a live ejection seat without double-checking to see that all the safety pins are installed?
- Do all of your men know what a black-and-yellow-striped handle means?
- Is your line crew checked out to prevent *inadvertent*:
  - Canopy jettison?
  - Ejection seat actuation?
  - Wing stores jettison?
  - Landing gear actuation?
  - Emergency oxygen actuation?

If not, your turn is coming and you may not be as lucky as this brake rider. See examples next page.

Remember, an ounce of prevention is worth more than a pound of cure in this business.



Case 1

This inadvertent ejection occurred aboard a carrier and resulted in fatal injuries to an inexperienced and unauthorized individual. He had entered the front cockpit of the RA-5C and triggered the ejection seat handle. Both seats and canopies were actuated in the process. The moral of this tragedy is simply—*If you don't know—Don't!*

Case 2

Message report of ground accident involving F-4B in hangar:

Inadvertent firing of ejection seat. Preliminary investigation reveals possible confusion of the ejection seat crew in regard to sequence of procedures during functional check following installation of Martin-Baker seat in rear cockpit. A rated AME was standing in the seat bucket when he pulled the face curtain for check, ejecting him and seat through the open canopy. He fell away from the seat just prior to the seat contacting hangar overhead, landing on top of the fuselage and rolling off onto the port wing.

Injury—Serious.

Notes and Comments on Maintenance

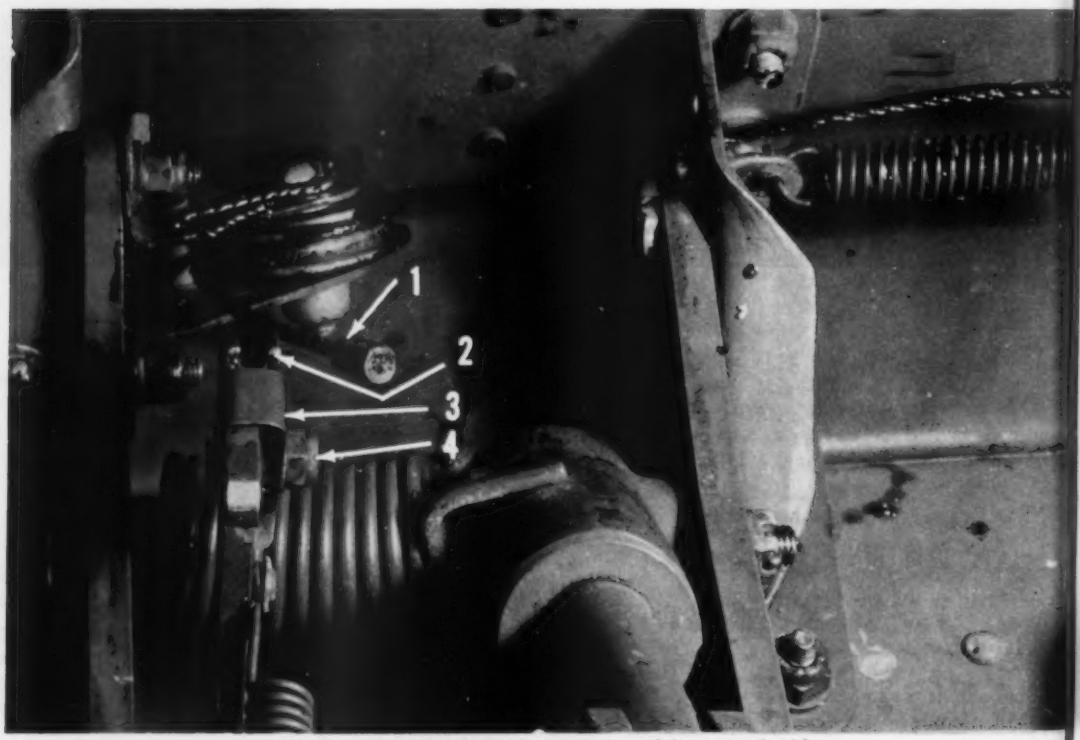
Close Call

WEATHER about 800 overcast, visibility about one mile with it decreasing in rain showers . . . at night.

The A-4 pilot experienced the loss of his main generator during this recon mission in WestPac. He attempted to deploy his emergency generator by pulling the T-handle . . . nothing. He pulled again and again without success.

This aviator now was without electrical power to operate his aircraft—main gyro, standby gyro, lights, navigational aids, radio and most of the trim control was out. His wingman knew something was wrong but not the whole story. This pilot gave the night HEFOE signal and indicated electrical trouble. His wingman then assumed lead and headed for the marshalling point for commencing a GCA.

This professional aviator now commenced his approach with his wingman. His fuel state was assumed to be within 200 lbs. of his wingman's—enough for about five go-rounds in the bolter pattern



INCORRECT INSTALLATION: Wrong-sized nut (4) permitted cable (1) to slip out of retaining bracket (3) and control arm slot (2).

if necessary.

When his wingman signaled that he should have the meatball, he detached for the final phase of his approach about a half to three quarters of a mile out. The LSO had no radio contact with him nor did the aircraft have external lights including an approach light.

The LSO using the SPN 10/12 for airspeed had to wave off the first approach which was too fast. With the aid of his 90-degree Boy Scout flashlight the pilot flew partial panel for a moment or two until he could see to rendezvous with his wingman for another approach. His second attempt was successful.

The A-4 approach was made with no speed brakes, flaps or trim. The pilot stated his speed control and almost full aft stick pressure (in order to hold the nose up) was difficult. He felt uncomfortable knowing his power was further back than usual in case of a bolter or waveoff.

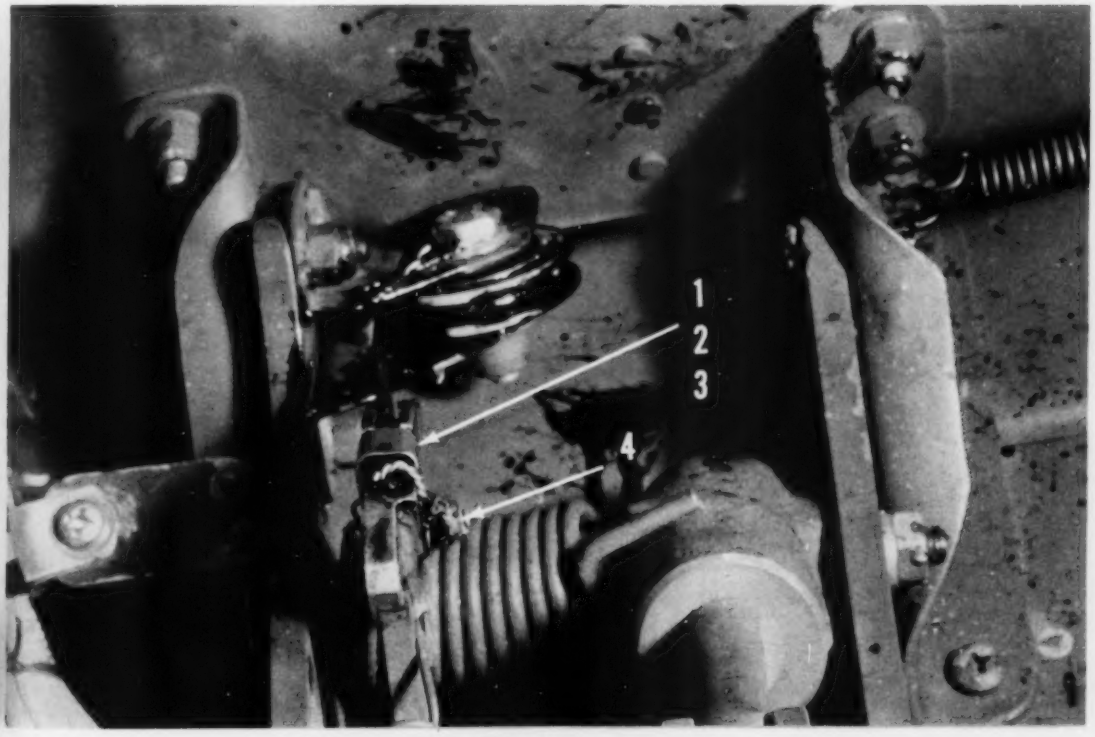
Headwork, teamwork, experience with a dash of professionalism paid off for this pilot.

Why did it happen? The retaining clamp (item 3 in lower left photo) which holds the T-Handle cable (item 1) in the dropout arm slot (item 2) slipped down allowing the cable to spring out of its slot. When the pilot pulled the T-Handle the cable was pulled to its limit when it jammed into the roller guide.

How did it happen? Somebody (undetermined) had installed an oversize locknut on the retaining clamp bolt (item 4). This prevented the locking feature of the nut to do its job—it was loose enough to allow the retaining clamp to slide down and the cable to slip out of its slot.

Action taken. Squadron maintenance checked all of the other aircraft for a similar possibility. Only one aircraft had a slightly loose nut but it was the right-sized nut. A member of the Enlisted Safety Council suggested a way to lockwire this nut. The suggestion was considered a sound idea in view of the importance of having an emergency generator available when needed.

—Contributed by ASO VA-113



CORRECT INSTALLATION: Cable in proper place, properly secured with proper nut and safetied with lockwire (4).

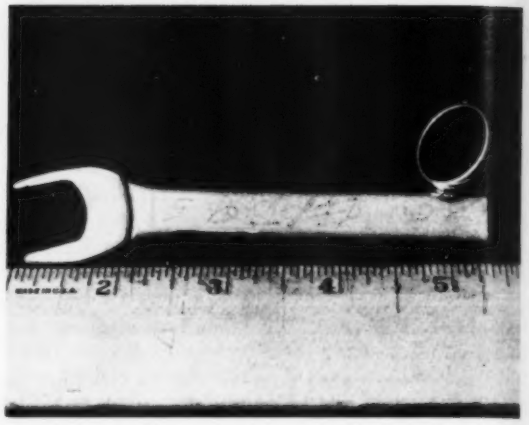
Stoof Mag Drive Gear Failures

INVESTIGATION of a recent accident involving the loss of the flight crew and strike damage to an S-2F revealed failure of the port engine magneto distributor finger gear to be a contributing cause.

Maintenance error was listed as a possible factor in that compliance with R1820 Power Plants Bulletin 614 had not been accomplished 20 hours previously. Revision B of the Bulletin requires inspection of the magneto finger gear 10-85955 at every interim and major maintenance period. The aircraft's last check was a calendar odd.

In the past two years there have been 11 reported failures of this component. It appears that in spite of the existing instructions (issued March 1964) worn gears still escape detection. In view of the scheduled service of S-2 into the mid-1970s, the importance of only the most careful inspection of this item should be stressed by all operators.

It has also been recommended that BuWeps consider the feasibility of replacing the micarta gear with one constructed of more reliable material. In the meantime mechs, give that finger gear your eagle eye.



This photo is worth a thousand words but here's the short of it: While tightening a loose starter terminal on a tow tractor, a mechanic's ring and wrench grounded to the tractor frame, welding his ring firmly to wrench. Injury—minor blistering of ring finger. Moral—wearing of rings, watches and other jewelry can be hazardous on the job.—LT D. Holcomb, VS-30

Chafing Note

DURING a spot quality control inspection of an S-2E, the port emergency down line, PN 121T10014-258 LGE-4, to the main landing gear door actuating cylinder, PN 121H10029-1, was found severely chafed and nearly worn through.

This chafing action had resulted from contact with the upper end of the MLG drag brace during gear actuation.

The landing gear door cylinder had recently been removed and repacked to correct a hydraulic leak. Upon reinstallation the cylinder was mounted so that the shuttle valve housing was rotated aft about 15 degrees placing the landing gear emergency down line in the operating arc of the drag brace.

Failure of this line in flight could have resulted in loss of all hydraulic fluid, including the emergency, if the landing gear emergency system had been activated.

—Contributed by VS-29

DO YOU KNOW THAT—Many ground filter/separators satisfactory for use with aviation gas are unsuitable for use with JP-type fuels unless the fuel flow is decreased? For example, a filter rated at 600 GPM flow with aviation gasoline must be down-rated to approximately 400 GPM to perform satisfactorily with JP fuel. If fuel flow is not decreased, the filter may collapse.

—KAMAN ROTOR TIPS

'Let's get the nut who designed this fool thing—maybe he knows how to assemble it.'

A-6A Tail Hook Hazard

REPORTS concerning the failure to install the A-6's tail hook ground safety uplock indicates that operators are not aware of the hazard potential of an inadvertently tripped hook.

Because the tail hook in the up position clears the deck by about 6 feet, people are continually walking under the tail of the aircraft during maintenance, on the line and in the hangar.

Without the safety uplock installed the tail hook is dangerous if inadvertently triggered. The tail hook dashpot is preloaded to 1000 psi and exerts forces upon a two-inch diameter piston to lower the hook. The force with which the hook drops has been known to knock holes in concrete decking—seems a body could be seriously hurt if he happened to be in the way.

Inadvertent triggering of the hook is most likely during maintenance actions within the aft compartment through which the uplock cable passes. In this area numerous black boxes exist and access is quite frequent. Even a slight depression of the cable can trigger the hook into a vicious swing upon the unwary if the ground safety uplock is not installed.

One other warning—if the hook is down it is dangerous to drop the electronics platform—it's possible for a man to be wedged between the platform and the hook—weight of the platform is about 700 pounds!

With the A-6A's tail hook down, caution should be exercised when dropping the electronics platform to avoid being trapped between the hook and platform which weighs about 700 pounds.

Lost Cap

RECENTLY an RF-8G launched on a high altitude photo mission. While at an altitude of 41,000 ft, the pilot noticed the cabin pressure altitude indicator steady at 7500 ft. A descent was made while returning to home field. Cabin pressure matched the altimeter after passing through 7500 ft MSL. A normal landing was made at the home base.

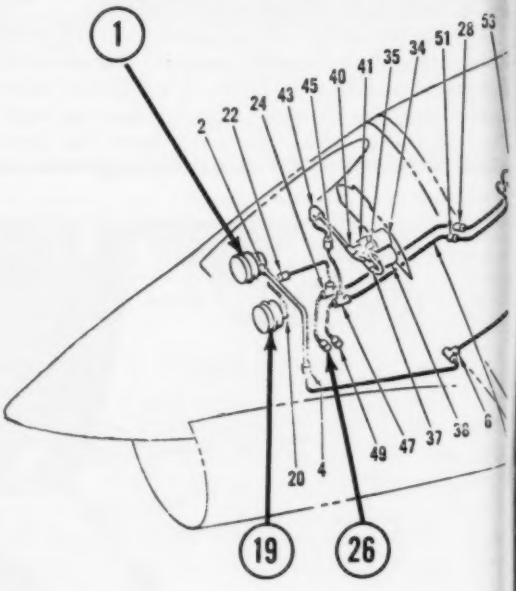
The cabin pressure altitude indicator was removed and tested. Tests revealed no discrepancies. A cabin pressure tester was employed after reinstalling the indicator. Pressure was applied to 5 psi at which point the cockpit pressure regulator (item 1 in drawing) should begin to operate. When this did not occur, pressure was increased to 5.5 psi. At this point, the cockpit safety valve (item 19) should operate to relieve excess pressure. When this did not occur, the pressure was allowed to build up to 6 psi. Further testing seemed to be useless.

The pressure was brought back to normal and the tester disconnected. A visual inspection of all lines and connections was made. A cap (item 26) was missing .

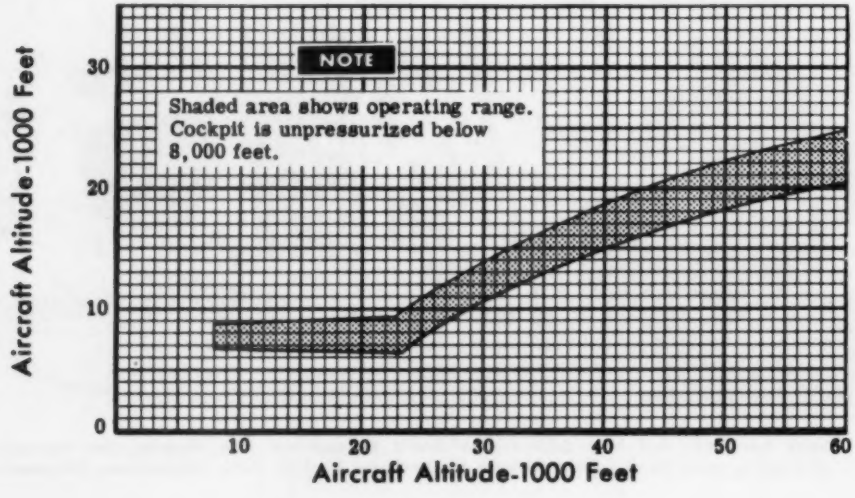
Upon investigation, it was found that when the cap assembly is removed from F-8 Aircraft, both the cockpit pressure regulator and the cockpit safety valve are locked and unable to operate. A broken line would produce the same results.

The F-8 canopy is manufactured to withstand a pressure differential of 8 psi at the weakest point before failure occurs. With the use of the ICAO standard Atmosphere Tables, the pressure differential between 7500 ft and 41,000 ft was calculated to be 8.56 psi. A pressure differential as small as 1 psi could rupture the lungs. The pilot was fortunate to have been flying an aircraft with a strong, well-built canopy.

The cockpit pressurization chart of the F-8 NATOPS Flight Manual has been reproduced in the form of kneeboard cards and distributed to squadron pilots to be carried on all flights.—*LCDR J. M. Schulze, Jr., ASO, VFP-63*



Cockpit Pressurization



FOD Prevention

TO help curb FOD (Foreign Object Damage) and to save the tax dollar at the Naval Air Station, Quonset Point a brilliant yellow vehicle called the FOD-Mobile was built.

The purpose of the FOD-Mobile is to arouse interest and call the attention of all military personnel and civilian employees to their responsibility in helping to eliminate FOD. It has been prominently displayed throughout the Air Station and shows vividly the results that are caused by FOD material found on runways and taxiways.

The largest item on the FOD-Mobile is part of a jet engine and its casing which was extensively damaged as a result of FOD material. Samples of objects ranging from paper cups, rags and tools to sonobouys can be viewed in the well of the vehicle.

Pound of Cure

P. WELLINGTON SCAGDRAGGER bounced into my office the other day and dropped the following pearls of wisdom in my ear.

"Sonny, I've seen sights and drunk drinks and done things that would put a curl in a hog bristle, but I'm back now and you can relax.

"I know it's been kinda hard on you young fellows, but from what I hear around the hangar you haven't done too bad—not real good mind you, but not too bad either."

The old rotorhead sat down in my soft chair, propped his feet on the desk, and said, "You know, boy, I've been looking around and about the big hangar and I got to thinking about accident prevention. Do you know that this Group has 2562 people in it, not countin' me and Willie? Now even you can figger that there's 5124 eyeballs in the Group—and those peepers represent one of the most potent tools for accident prevention in the world. You take 5124 eyeballs backed by 2562 alert brains and motivated by a desire to stop accidents before they happen and your accident prevention program should really move.

"Well," he continued, "you have the eyes and I can presume you have the brains. But when you start looking for alertness and motivation, I see fellas wandering around the hangar with their eyeballs caged and their minds a million miles away. I've seen good safe pilots observe a potential accident, either in the form of hazardous conditions or the continued practice of dangerous flight habits by their buddies, and not do a blessed thing about it. Now these same folks would never think of leaving a board full of rusty nails on a swimming beach. Well, the same motivation that makes any thinking man pick up a rusty nail or a piece of broken glass should extend right into his attitude towards his job and the place where he works. It's all part of the same picture.

"People have been aware of the basic idea behind accident prevention for a mighty long time. How many times have you heard something like this—An ounce of prevention is worth a pound of cure—Close the barn door *before* the horse gets out—A stitch in time saves nine—? What it all boils down to, though, is that there's only one good kind of accident—the one that never happened.

"People cause most accidents, sonny—and it follows that people can prevent most accidents. You get the word to your 2562 people to keep awake, observe, and most important, take action when they are aware of any situation that might lead to an accident. We can spend millions of dollars on Safety, but it's not gonna pay off until every single one of your folks get in the act, aggressively, enthusiastically and continuously fighting toward the goal of accident-free operations."

"One of the best ways to get your people hot on this safety business is to make it easy for 'em to tell you what the problem is without having to fill in a gosh awful report with six references, two enclosures and typed in ziplicate!

"Make it simple! Ask 'em to call you immediately when they spot something hazardous, or dash off a quick note and send it to you in the guard mail. Sorta like that Anymouse Program the Safety Center has, or the Operational Hazard Report (OHR) System, only on a local scale.

—Adapted from the MAG-26 "Safety Raiser"

Shipboard Test Cell Usage

THE PROPER approach to aircraft engine maintenance dictates that all facilities and technical ability be utilized. USS AMERICA (CVA-66)/Attack Carrier Air Wing SIX (CVW-6) team utilizes the onboard Jet Engine Test Cell.

Jet Engine Test Cell control room aboard USS *America* is monitored by (L to R) R. E. Hollenshead, ADJ1; J. J. Johnson, ADJ1 and W. Moore, ADJC.

On 15 April, just one year after commencing aircraft operation from USS AMERICA the IMA Jet Engine Test Cell performed its 100th jet engine test run. This along with "O" and "I" level technical ability has resulted in quality-assured aircraft engines. There have been no inflight jet engine failures in CVW-6 during nine months of carrier operations from USS AMERICA. How do other shipboard jet test cell operations compare on utilization of the cell?—*J. C. Sargent, LCDR, Maintenance Officer*

Murphy's Law *

'There are no isolated cases. The first failure constitutes a trend.'

Beech Fuel System MURPHY

DURING a local VFR flight, both engines of a photo *Beechcraft* (RC-45J) quit at 4500 ft, 15 minutes after takeoff while operating with the fuel tank selector valve on RIGHT MAIN. The fuel quantity gage on the right main tank read 10 tenths on takeoff. The pilot selected another fuel tank and both engines responded. A safe landing was made.

Maintenance had removed, inspected and replaced the Fuel Tank Selector Shaft, Part Number 894-189252-14, item 71, Fig. 86 of an 01-90CE-4 for possible binding. The RC-45J having no nose tanks installed has two OFF positions marked on a placard below the fuel tank selector valve handle; one at 12 o'clock and one at the 6 o'clock position.

The handle and shaft assembly was removed by pulling pin, Part Number 105714-6-1-6, item 73, Fig. 86 of AN 0-1-90CE-4 from one RC-45J with the selector valve handle in the six o'clock position by one man and installed in RC-45J 39217 by two different men with the selector valve handle in the 12 o'clock OFF position which was 180 degrees from removal position causing fuel to be used from the Left Aux. tank vice Right Main tank. Left Aux. ran out of gas 15 minutes after takeoff because NATTU operates aircraft with only three to four tenths fuel in the auxiliary tanks due to weight restriction resulting from heavy photo equipment installed.

This unit has taken the following action to prevent recurrence of this Murphy:

- Replaced the word "OFF" located at the 6 o'clock position on the fuel tank selector valve placard with the words "NO NOSE TANK."
- Conducting closer supervision and work completion inspection on maintenance performed.

—Contributed by LCDR P. L. Wells, NATTU Safety Officer

F-8 Electrical Murphy

ON test hop of an F-8 aircraft coming out of check, the pilot observed no exterior lights. Upon trouble-shooting the circuits it was discovered that the cannon plugs on the IFF and exterior lights control boxes were *reversed*. It is more or less common knowledge that the IFF and SIF control box cannon plugs can be reversed; however, it is not readily apparent that the same Murphy exists on the lights control box. All three controls are mounted in a row in this aircraft. Although the cannon plugs for the IFF and SIF are marked, what happened in this instance was that the SIF was connected correctly and the next cannon plug was connected without checking the marking. F-8 operators should be made aware of this potential murphy.

* If an aircraft part can be installed incorrectly, someone will install it that way!

Letters

Want your safety suggestion read by nearly a quarter of a million people in naval aviation? Send your constructive suggestions to APPROACH.

Painful Shortcut

NAS Corpus Christi—An airframes mechanic received severe arm bruises when the TS-2A tail hook was retracted while he was lubricating the up-lock. He had dropped the hook and then put the control lever UP so he could raise the hook without returning to the cockpit.

While he was working, other members of the check crew applied electrical power and hydraulic pressure using a ground test unit. The tail hook raised pinning the man's arms.

Although the mechanic escaped serious injury, he got a better understanding of why control levers and components controlled must always correspond and why a thorough check of cockpit controls must be made prior to applying power of any kind.

GROUND SAFETY OFFICER

• In addition to crippling one's self this way, there are numerous instances in which the bird was damaged too. Shortcuts of this type can be serious hazards.

Safety PO Program Pays

NAS Corpus Christi—Training, safety inspections and accident prevention are all dividends received from the VT-28 Safety Petty Officer watch. Unsafe practices and conditions are now corrected in the shortest time possible while petty officers first class in the maintenance department receive training in ground, line and industrial safety.

The maintenance chief assigns POIs to the week-long watch supervised by the general safety officer. The Safety PO then patrols the line, hangar and shops on the lookout for safety hazards and malpractices that might result in hazard to life or property. Most discrepancies are corrected on the spot; however, some require more extensive action and are reported to the general safety officer, who prepares a "Safety Hazard Report." The form is made into two parts; the top half outlines the hazard and shows routing to the cognizant supervisor; the bottom half is used for reporting action taken and routing back to the general safety officer. Copies of each report are maintained to establish a follow-up system.

The safety POs, who at first were reluctant to take on-the-spot action, have found that immediate steps to correct discrepancies result in less recurrence of unsafe acts and also go a long way toward establishing respect for the safety PO. Each week fewer and fewer safety hazard reports are issued, and a general tightening up of safety precautions has been noted throughout the squadron.

Being safety-conscious for a week doesn't wear off quickly and the PO returns to his shop with a more critical eye and more knowledgeable in regard to safety. He passes his knowledge down to the men working under him and at the same time aids his supervisor in eliminating unsafe conditions in the shop.

GEORGE A. ROGERS, JR., LT
GSO, VT-28

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request. Address: APPROACH Editor, U. S. Naval Aviation Safety Center, NAS Norfolk, Va. Views expressed are those of the writers and do not imply endorsement by the U. S. Naval Aviation Safety Center.

Feed the Bobcat

NAS Chase, Tex.—This idea was recently devised as a means of eliminating the FOD problem on the line. The container is simply mounted and secured

FOD Eater at Chase

on an NC-5 at the beginning of the day. FOD is placed in the container through the spring loaded door and is emptied at the end of the day. The container has been in use for approximately one month and is getting a fine reception from the line crew.

J. L. BERRY, LCDR
ASO, VT-24

Desert Solar Still

Santa Ana, Calif.—Just as a matter of interest in followup to your article on the desert solar still in the February 1966 APPROACH, page 23, this squadron has manufactured a small, very compact, kit from items of general use in the shops of most squadrons. This kit contains the following items:

a. Kit Container: Bag Plastic, Vinyl Film PN 75-285-59-1250 Held by most flight equipment departments.

b. Plastic Film, ScotchPac or Dupont's "tedlar" used for packaging material by the Navy Supply System.

c. Four Qt Bucket: Heavy Duty aluminum foil used for packaging material by squadron material departments.

d. Plastic Tubing: Type tubing B-5 AWG CM or IM .208 Nom I. D. ATK GF 5970-221-5313 used by avionics departments.

e. Instructions: Duplicated from *Crossfeed* article "Water for Survival," *Crossfeed* 9-65, by group safety office.

This compact kit is nil in manufacturing cost, weight, and size and can be carried with comfort in the flight suit, flight jacket, or SV-1 survival vest or installed in the seat-pan kits.

JOSEPH M. MORROW, 2NDLT, USMC
H&MS-33 FLIGHT EQUIPMENT OFFICER
MAG-33 MCAS EL TORO

• Your kit looks good to us. Thank you for sending it in.

Materials for still kit

Compact kit

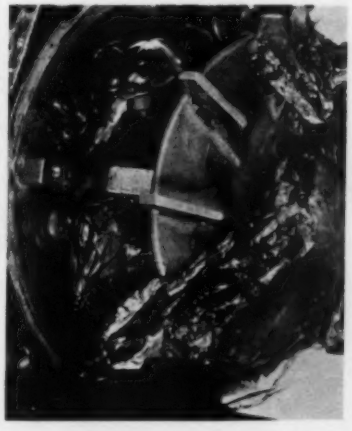
It's in the Bag

NAAS Whiting, Fla.—Filmy plastic dry cleaner bags are fine for protecting freshly cleaned clothes while enroute home from the cleaning establishment, but they offer little security in the aircraft for your RON clothing and can cause damage to your flying machine.

The photo (right) shows what can happen when a 250 VA Inverter tangles with one of these bags. The inverter, located in the rear storage compartment of a C-45 drew the bag into the cooling fins cutting off the air flow. The result: overheat and a burned-out inverter.

Canvas or heavy weight vinyl clothes bags protect clothing and stay where they are put—keep the dry cleaner bags out of aircraft.

C. E. BURGI, LCDR
ASO



Cleaning bag is hazard

Rear Admiral L. D. Coates Award Open to Nonmembers

THE Rear Admiral L. D. Coates award is an honorary award developed by the BuWeps—Industry Material Reliability Advisory Board (BIMRAB) and is named in honor of RADM L. D. Coates, who was the first chairman of BIMRAB. This award has been limited to members of BIMRAB in the past, but is now expanded to include one recipient annually from the Navy and Navy/Industry complex who is *not* a member of BIMRAB.

The criterion for this award is that the recipient must have made an outstanding contribution toward the achievement of BIMRAB objectives, reliability control or systems effectiveness. The objectives of BIMRAB are to develop and recommend workable procedures to enhance:

1. Reliability, maintainability, serviceability, and safety requirements of weapons systems and materials for maximum operational integrity;

2. Methods of test, demonstration, and unique maintenance procedures to achieve the foregoing objectives;

3. Feedback and dissemination of technical information from field activities, operating forces, and industry. The award consists of a certificate which is presented in a ceremony at the BIMRAB Conference.

Nominations are solicited from naval activities and Navy contractors. Nominations will include full description of the contribution, together with photographs and sketches, as appropriate, and should be authoritatively reviewed for accuracy and effect prior to submission.

Nominations should be submitted to—Secretary to BIMRAB, Bureau of Naval Weapons (RREN-23), Washington. D. C. 20360—and must be received by 1 July 1966 to be considered for presentation of the award at the BIMRAB Conference on 25-26 October 1966.

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Our product is safety, our process is education and our profit is measured in the preservation of lives and equipment and increased mission readiness.

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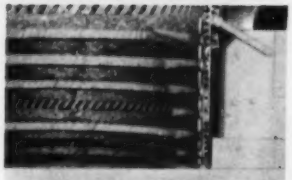

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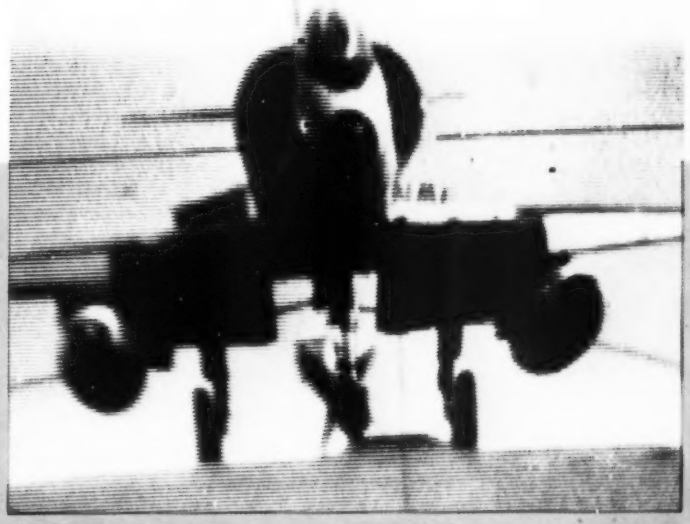

'Aircraft In The Groove Has Hung Ordnance'

LIFT and DRAG

How many times do we hear this on the 5MC? I'll bet that it really doesn't turn very many heads or change anything.

The AGM-12B Bullpup "A" has a capability for arrested landings, *but check the photo.* Upon examination of the complete plat tape we found that the missile slides smartly up the rail on arrestment, strikes the nose gear and falls to the flight deck.

After breaking into pieces upon impact with the deck, the missile continued up and off the angle. Fortunately, no one was hurt and the aircraft suffered no damage.

The point is that there is a constant requirement to keep unnecessary personnel off the flight deck and make sure that everyone who works in this environment stays alert. This includes the pilot who gets taxied forward after recovery and enjoys a Sunday stroll back to the island while other aircraft are still recovering.

—Attack pilot